RAILROAD GAZETTE

RAPID TRANSIT IN NEW YORK.

When the Ninth avenue elevated road was built in 1876 as far north as Fifty-ninth street and was followed in 1878 by the Sixth avenue line built as an independent project, and in 1879 and 1880 by the Third and Second avenue lines respectively, the citizens of New York congratulated themselves that they had secured true rapid transit for all time. For a brief period, persons living in the northern part of the city and going to business daily in the southern part were enabled to make the trip not only quickly but comfortably, and the surface lines reflected the better facilities offered by the elevated roads in a marked falling off of traffic; but New York, shaped like a lead pencil, with the business done at the point, outgrew the capacity of its elevated lines many years ago, while the surface lines, spreading in extensions and ramifications unthought of in 1876, not only regained many times the lost traffic but became so congested by the movement of cars alone, apart from street obstructions, that in the words of President Vreeland, they no longer attempt to furnish rapid transit, and do not really compete nor desire to compete for the through travel. In a paper printed in the *New York Sun* last year, Mr. Samuel Whinery made a forecast of New York's future transportation needs which was at once startling and pessimistic in view of what it is apparently possible to accomplish. He quoted Mr. W. W. Wheatly to the effect that while in 1860 the average number of rides per capita in what is now the Borough of Manhattan was only 47, in 1880 it had risen to 182, in 1900 to 388, and in 1903 to over 400. At the same general rate of increase, the rides per capita in Manhattan Borough alone would reach about 550 by 1915. Although when the entire population of Greater New York is included, the number of rides per inhabitant is somewhat less, Mr. Whinery believed it safe to estimate that this number in 1915 would not be less than 400. (*Railroad Gazette*, Nov. 20, 1903). On this basis, with a conservative allowance for increase in population, the number of passengers to be provided for eleven years from now would reach the stupendous figure of 2½ billions, or just about double the number that now rides.

Much space has been given in the present issue to a description of the New York Rapid Transit Subway, which is now nearly ready for public use. Its construction was a remarkable engineering feat, for it was necessary to cut for a considerable part of the distance through solid rock, and to build a tunnel structure close to the surface of streets extremely congested with surface traffic, so that even slight obstructions caused by the work created a serious difficulty. It was necessary to use the methods of heavy railroad construction in a rocky country as modified by the extremely onerous limitations of the most crowded American city; but the work was completed, so far as essentials are concerned, considerably ahead of the contract time, in spite of the strikes which may be so confidently counted on to obstruct any kind of construction work done on a large scale in the city of New York.

The Rapid Transit Subway, like the new elevated lines of 25 years ago, may be expected to relieve the congestion of traffic only for a brief time. Geographically, Greater New York does not cross the Hudson river, but the cities of Jersey City, Hoboken, Bayonne and Newark pour their thousands into the Metropolis every day. These four cities had a population of 407,564 in 1890 and of 544,589 in 1900, an increase of over 33 per cent. Every town in Hudson, Essex and Bergen counties contributes to the myriads for which the railroad system of New York must furnish transportation. These counties had a population of 579,450 in 1890 and of 823,541 in 1900, an increase of over 42 per cent. From the west bank of the Hudson to the cities of Elizabeth and Paterson, distant 13 and 16 miles respectively, the intervening territory may be described as one continuous city, where dwell at least one million people. It is estimated that in 1902, 108,500,000 persons were brought to the city by the Hudson river ferry fleet. The subway may be expected to have a capacity on its four-track section of some 350,000 passengers a day, or perhaps 125,000,000 a year, to be added to the present carrying capacity of all local transportation lines in Greater New York, estimated at approximately 1,167,124,000 a year. The utter disparity of these combined figures with the number of rides which it may be reasonably expected will have to be provided for only eleven years hence, according to Mr. Whinery's conservative estimate, is the true measure of New York's transportation problem, in which scheme of transportation the subway is only a single link.

The principal engineering features of the subway were so fully described in the last report of the Rapid Transit Commission, a full extract of which was printed in the *Railroad Gazette* of Sept. 4, 1903, that they have only been touched upon in the series of articles in the present issue. The work has so many sides and so many different aspects of interest that it has seemed best to describe it in five separate articles, so that each of the main topics will be found complete in itself. These topics deal with early transportation in New York, with the history and physical aspects of the subway, with its traffic features, its power equipment and its safety devices. In addition, a paper is reprinted from the Proceedings of the Institution of Civil Engineers of London, describing the method employed in building the tube railroad in that city by tunneling with a shield through the stiff blue clay. This work affords an interesting contrast with the building of the New York subway.

THE ENGINEERING STANDARDS COMMITTEE.

The English Engineering Standards Committee has been doing much more work than is generally known in this country, and it has covered more ground than any one of our societies here. On page 348 we give a diagram, or tree, starting with the Main Committee, and showing how the sub-committees have branched out from it. The Committee on Electrical Plant has grown both ways from the center, and is now sprouting out at one end. It bids fair to equal all of the others combined if it keeps on growing. The Main Committee has complete control of this work, and is composed of men well fitted to carry it through to successful completion. They are as follows:

James Mansergh, Esq. (chairman); Sir William White, K.C.B.; Sir Benjamin Baker, K.C.B.; Sir John Wolfe Barry, K.C.B.; Sir Douglas Fox, J. A. McDonald, Esq. (Midland Railway); Prof. Unwin (City and Guilds of London Central Institution). *Nominated by the Institution of Civil Engineers.*

E. Windsor Richards, Esq. (Guest, Keen & Nettlefolds, Ltd.), William H. Maw, Esq. *Nominated by the Institution of Mechanical Engineers.*

G. Ainsworth, Esq. (Consett Iron Co.); Arthur Cooper, Esq. (North-Eastern Steel Co.) *Nominated by the Iron and Steel Institute.*

Archibald Denny, Esq. (Wm. Denny & Bros.); Francis Elgar, Esq. *Nominated by the Institution of Naval Architects.*

Sir William Preece, K.C.B.; Col. Crompton, C.B. (Crompton & Co.). *Nominated by the Institution of Electrical Engineers.*

Dr. Tudsbery (Hon. Sec.) Institution of Civil Engineers; Leslie S. Robertson, Esq. (Sec.), 28 Victoria Street, S. W.

The first work undertaken by the committee was the standardization of rolled sections used in shipbuilding, etc. This work was completed some time ago and issued in convenient form for use. It covers equal angles, unequal angles, bulb angles, bulb tees, bulb plates, Z bars, channels, beams and T bars.

This was followed by a very complete set of tables, giving "Properties of British Standard Sections." These are both well known in this country, and many have wrongly drawn conclusions that the matter of specifications and the testing of materials were not being considered by the committee; but, as a matter of fact, this is a very important part of their work, and several specifications have already been issued, as shown by the following: Specifications and Sections of British Standard Tramway Rails; Report on the Influence of Gage Length and Section of Test Bar on the Percentage of Elongation, by Professor W. C. Unwin; British Standard Specification for Tubular Tramway Poles; Forms of Standard Test Pieces; British Standards for Electrical Machinery. In addition to these the committee is now working on specifications and tests for steel castings and forgings used in marine work, and specifications of locomotive steel plates, tires, axles, steel springs, steel bull-head rails, flat bottom rails, etc.

Mr. Leslie Robertson, Secretary of the Main Committee, is now in this country to learn at first hand what has been done here toward standardizing specifications, and to give our engineers full information as to what has been done by his committee up to this time, and what work they now have under consideration. These meetings will be held in New York City and Chicago. They are, in a sense, preliminary meetings to decide on subjects that can be taken up to the best advantage at the Engineering Congress in St. Louis. It is expected at that time that there will be a general discussion on the most important features of specifications for

structural steel, rails, etc. The importance of the work which the committee is doing is, perhaps, not fully appreciated. We have already commented on the desirability of international standards for testing materials, but after all such standards are but a preliminary step towards the adoption of international standard shapes, etc. If the work which the committee is promoting is carried to a successful end, it will have served a useful purpose, and the ends desired certainly warrant the hearty co-operation of all interested in the manufacture and design of engineering materials.

MUTATIONS OF RAILROAD INVESTMENT.

The mutations of railroad investment in the United States may be divided into four periods, each with pretty distinctive lines of demarcation. The first takes us through what may be classed as a kind of "empirical" and speculative epoch, reaching from the first railroad ventures in the thirties down to the close of the Civil war in 1865. As the adjectives prefixed to the period imply, the railroad building and railroad projects of the time were, for those days, venturesome. The great future of American railroads was unforeseen or seen but dimly; as new investments railroads were rated as hazardous, if not extra-hazardous; the dividend rate which could carry the market price of a railroad stock to par had to be high—as high, sometimes, as eight or ten per cent.; and the few bonds issued at a period when bonds were unclassified and usually simple first mortgage securities, also had to carry a seven per cent. return to lift them to the par point of 100. Consolidation had hardly begun; but the basic stems had been laid for the great systems which were to come.

The second period reaching, in a general way from the close of the Civil war down to 1880, inclusive, is historically perhaps the most interesting of all to the student of railroad investment. Its leading features—the onset of the fever of railroad building, the first important steps in consolidation, the struggles of rivals for territory and all leading up logically to the panic of the autumn of 1873 and the years of stress that followed—are too familiar to need rehearsing at length. But two investment features of that period never seem to have attracted due attention. One was the persistency with which railroad bonds of high security continued until somewhat later than 1873 their profitable return to the investor of six or even seven per cent.; and a second feature was the fall of that return to a point usually between 4 and 5 per cent. during the latter part of the "long drag" between 1873 and 1881. First class railroad stocks that continued their dividends fell decidedly during the stressful years following the great panic; but, in general, first class railroad bonds slowly but pretty steadily rose. The seeming anomaly had, however, its explanation in the psychology of railroad investment. Hard hit by losses in stocks and with fears of other losses to come, the railroad investor turned to gilt-edged bonds, and the demand reduced the return on them to the 4 per cent. rate, which has never since been exceeded except for a few months at the very bottom of the depths of financial depression. In this steadiness of the better classes of railroad bonds reaching now through almost three decades of time is to be found the strongest pledge of the intrinsic soundness of the American system of railroads in its relations to investment capital.

The third period, spanning some eighteen years following 1880, had also some impressive characteristics. Consolidation became active—though not, as in later years, stupendous—and with the extinction, in many cases, of local rivalry came the epoch when questions of rates were transferred from legislatures and State railroad commissions to federal jurisdiction. Railroad construction leaped about 100 per cent.; and the dividend and interest return for the investor ran steadily down until the holder of old 7 per cent. bonds found his income reduced one-half. To the latter part of this period belongs, too, the electric railway rivalries with steam and an entirely new set of problems for the steam railroads to solve; problems which are not solved yet—the electric roads meanwhile creating not merely a form of competition in traffic but in investment also.

So we have reached the fourth and present epoch with its "high finance," in which the investor fronts a set of conditions, in many respects quite new and often puzzling. During the last four or five years he has gone to bed at night deeming himself the owner of a certain block of shares of high-grade railroad stock with voting power; he has waked in the morning to find his voting power passed over to a holding company and "blanket mortgage" bonds displacing his stock. He has gone to business in the morning as a shareholder in one company and returned home in the afternoon to find his personality lost in a corporation of other interests and bearing another name; and, to generalize broadly, he has found his individuality merged, faded and all but eclipsed in the mazes of new combination, carrying sometimes an Ossa upon Pelion of new obligations. If the railroad investor is a holder of an old bond of quality, whether senior or junior, he can go to bed and sweet rousing; otherwise, with the risk of awaking to rude surprises. In the second period of our study—a period of adversity—the stockholder was apt to be snuffed out by foreclosure of the underlying mortgage; in the last period—a period of prosperity—he has been snuffed out by the reverse process of plastering a mortgage over stock. In what we may call, in perhaps too stilted terms, the four ages of railroad investment—Projection, Reaction, Expansion and Consolidation—the last, while much the shortest, has also been the most dramatic.

Will the dramatic age prove also a tragic one? Will "high finance" and the changes wrought by great aggregations of capital in few hands and too often used selfishly spell the downfall of the smaller individual rail road investor? We do not think so. Sharply as the device of the too often speculative "holding company" is to be criticized in certain directions, it has not always involved large increase of new stock; the character of the stock is known; and the foreclosure powers of the new and great issues of bonds, if exercised hereafter, is likely to be at the expense of the holding company, and the old shareowners will merely come again to their own. Over and above all else is that immutable law of the final conservatism of capital by which sane reaction invariably follows speculative action and overtakes it. The rail road investor who has lived in manhood for a third of a century or more has seen many shiftings of railroad conditions, and he will probably see more—for example, some striking readjustments in the relations of railroad securities to the market and to each other as the steam-electric problem moves toward solution—but his property is there in concrete shape and under conditions of value both intrinsic and enduring.

The construction of the New York subway necessitated the tearing down of a 12-story steel building at Broadway and Forty-second street. This building, although built early in 1899, gives nevertheless some interesting facts concerning the permanence of structural steel. When the building was built the steel work was given two coats of paint composed of carbon and linseed oil. Some of the columns and girders were incased in shells of brick and some in terra cotta. Where terra cotta was used the space between the steel and the terra cotta was filld in with brick and cement mortar. Inspection showed that the steel work was in first class condition; the few rust spots evidently having been on the metal at the time of erection and were due to abrasion of the paint. The outer columns and girders were also in good condition. Of course, accurate conclusions cannot be drawn from these observations owing to the short time which the building stood. It is pretty well known, however, that the permanence of structural steel depends greatly on the condition of the metal before the preservative coating is applied. Paint will not stop the destructive action of a rust spot. The surfaces of the metal should be thoroughly cleaned before the paint is applied, otherwise oxidation once started will continue to eat its way into the material beneath the surface of the paint.

Denver & Rio Grande.

The most profitable year in the history of the company, so far as net earnings are concerned, was that ending June 30, 1902, when, with gross earnings of $17,036,828 net earnings were $6,705,286, on the 2,347 miles of road worked; an average of $2,857 net per mile. In 1903, although gross earnings increased nearly $268,000, operating expenses increased still more, so that net earnings were somewhat smaller than in 1902, and this current year the road has had to bear the brunt of the protracted Colorado miners' strike, amounting to little less than civil war in some localities; but, although gross earnings were reduced to $16,446,435, expenses were also reduced, so that the decrease of $858,125 in gross only cost the road $286,718 in net. As a matter of fact, owing to the omission of the charge against net income for extraordinary betterments and for worn out narrow gage equipment, a surplus of $234,413 was carried to the credit of profit and loss, as against $185,765 last year.

The Denver & Rio Grande has for many years been unique in that with a system made up partly of standard gage and partly of narrow gage the narrow gage mileage has approached that of the standard gage. Ten years ago the system included 1,201 miles of standard gage and 962 miles of narrow gage. In 1899, with an increase of the standard gage to 1,234, the narrow gage had been increased to 1,034; but since then the standard gage mileage has been increased evenly, while the narrow gage mileage has been almost as evenly decreased, until, at the pres-

ent time, over 62 per cent. of the total mileage is standard gage. The company has had it constantly in mind that its narrow gage lines were likely to be of more or less temporary duration, and consequently it has freely written off the value of its narrow gage equipment, but has hesitated to buy any new cars and locomotives of this type. As a result, it was mentioned in the report last year that a considerable part of the narrow gage freight equipment was 25 or more years old, and that it was at once desirable and economical to replace much of it with modern equipment, in spite of its temporary nature. To accomplish this, during the last fiscal year an equipment trust was arranged, covering 1,700 narrow gage freight cars in addition to 500 standard gage coal cars and a small amount of passenger equipment. The securities issued bear 4½ per cent. interest and aggregate $1,500,000 par value, to be met, principal and interest, by 20 semi-annual payments.

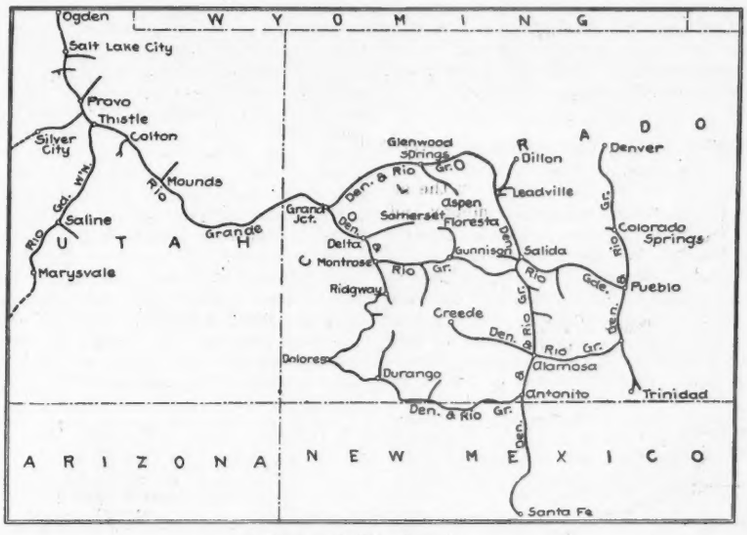
The railroad company has now transferred its express business to the Globe Express Company, incorporated under the laws of Colorado and controlled by the Denver & Rio Grande through ownership of the entire capital stock. As a result of this transaction, both earnings and expenses from express traffic have, of course, fallen off during the year. General freight earnings decreased $883,387 from the preceding year, amounting to $11,398,104. Passenger earnings, however, increased $131,327, to a total of $3,959,252. Of the decrease in operating expenses to an aggregate of $571,407, $300,872 is accounted for by the smaller cost of conducting transportation. Express expenses, as explained above, decreased $116,483, while maintenance of way and structures decreased nearly $120,000. The charge for maintenance of equipment also was slightly smaller than last year.

The Denver & Rio Grande reports are always full and explicit, so that it is possible to trace accurately the betterment work done, and observe the account to which it was charged. Last year, as previously stated, $417,547 was charged net income for extraordinary betterments; $630,628 was charged to operation, *i.e.*, maintenance, and $287,478 to cost of road, making a total betterment expenditure of $1,335,652. This year the total expenditure under this head, including everything not otherwise specifically charged to equipment or to maintenance, amounted to $873,300. Of this, $445,168 was charged to operation. The remaining $428,132 was divided into three parts; $236,980 was taken care of by the improvement fund from tracks taken up; $111,621 was charged to cost of road, and $75,530 to the improvement fund from inventory surplus.

The principal statistics of operation were as follows:

	1904.	1903.
Mileage Worked	2,398	2,378
Gross earnings	$16,446,435	$17,304,560
Freight earnings	11,398,104	12,281,492
Passenger earnings ...	3,959,252	3,827,924
Operating expenses..	10,058,444	10,629,850
Conducting Trans	5,469,145	5,770,018
Main. way and struc.....	2,174,828	2,293,465
Main. of equipment.....	1,919,519	1,942,914
Net earnings	6,387,991	6,674,709
Net income	6,602,336	6,884,426
Fixed charges and taxes	3,787,779	3,694,395
Surplus for year	2,574,413	2,962,561
Betterment appropriat'n*	120,000	537,547

*Including renewal fund.



Denver & Rio Grande.

The classes of structures adapted to different conditions, show some of the characteristic differences between American and foreign designs and illustrate some primitive or obsolete constructions besides recording important and well-known examples so as to have their principal data easily accessible." The types of bridges which can be classed as arch spans are treated in this volume under four heads, wood and iron spans, steel and iron spandrel braced arches, steel and iron arch trusses and steel and iron plate girder arches. Some 80 examples have been selected from among structures of this class situated in widely different parts of the world, and the characteristic features of each are briefly pointed out in connection with the illustrations from drawings and photographs. The author has refrained from theory or speculative comment and has included little mathematical or analytical data in the descriptions. In many cases only the details of construction which distinguish any one bridge from others of the same class have been selected, and as a whole the book presents a collection of data and information valuable alike to the engineer, contractor, student, draftsman or municipal officer. It is essentially practical.

NEW PUBLICATIONS.

Details of Bridge Construction. Part I. Arch Spans. By Frank W. Skinner. New York: McGraw Publishing Co., 1904. Price $3.

This is the first volume of a series of books in which the purpose of the author is "to present the development of advanced practice and its standard details, to illustrate

TRADE CATALOGUES.

Chicago Tool & Supply Company, Chicago, sends a circular of its "Green" pneumatic hammers. The hammer is shown complete and also unassembled, there being but 10 parts to it. A description is given and also a table of sizes with piston diameter, stroke in inches, capacity, weight in pounds, length in inches, blows per minute and cubic feet of free air consumed. The circular is neatly printed in black and red.

The McClintic-Marshall Construction Company, Pittsburg, Pa., are distributing an illustrated pamphlet descriptive of some of the foundries and machine shops which it has built. It has an appropriate cover artistically executed in colors. Among the full page half-tones shown are illustrations of the exterior and interior of the machine and erecting shop of the P. & L. E. R. R. at McKees Rocks, Pa.

The Glacier Metal Company, Richmond, Va., are distributing an illustrated post card which gives an outline of the political situation up to the present time. It mentions that there are about 131 doubtful States. Notwithstanding this the company is not at all uneasy about the situation, for they feel that the whole country is solid for "Glacier."

The C. W. Hunt Company, New York, sends an illustrated catalogue descriptive of its coal handling machinery for use in power stations, boiler rooms, coaling stations, etc. Industrial railways, electric locomotives, etc., are also described.

CONTRIBUTIONS

Steel Car Design.

Belleville, Pa., Sept. 7, 1904.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the *Railroad Gazette* for July 22 in the article on Steel Car Design, should not the equation for moments at any point in the center sills due to the weight of the car body be

$$M_x = \frac{p_1 x}{2}\left(\frac{x}{l} - 1 + \frac{c}{x}\right)$$

instead of

$$M_x = \frac{p_1 x}{2}\left(\frac{l}{x} - 1 + \frac{c}{x}\right)$$

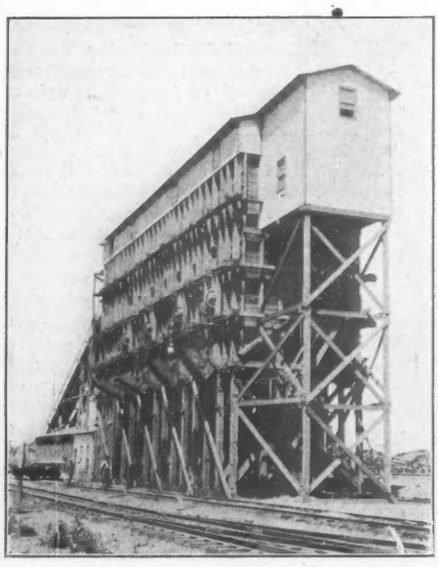
E. HERMANSEN.

Our correspondent is right. The error was a typographical one and does not affect the subsequent equations or values in the tables. —EDITOR.

The Telautograph in Railroad Service.

Gray's Telautograph, a telegraph instrument which records a message at the receiving end in the handwriting of the sender, and with which the readers of the *Railroad Gazette* are already acquainted, is now in use at the Union Station, at St. Louis, for announcing at various points in the station the prospective arrival of trains, and we understand that the apparatus is giving marked satisfaction.

The sending operator is in the signal tower at the entrance to the station yard, and he writes (sends) his message announcing each train as soon as the train comes within sight; and as all trains run past the tower and are backed in, this gives the men in the station about five minutes advance notice. During the busy hours of the morning and evening the sending operator

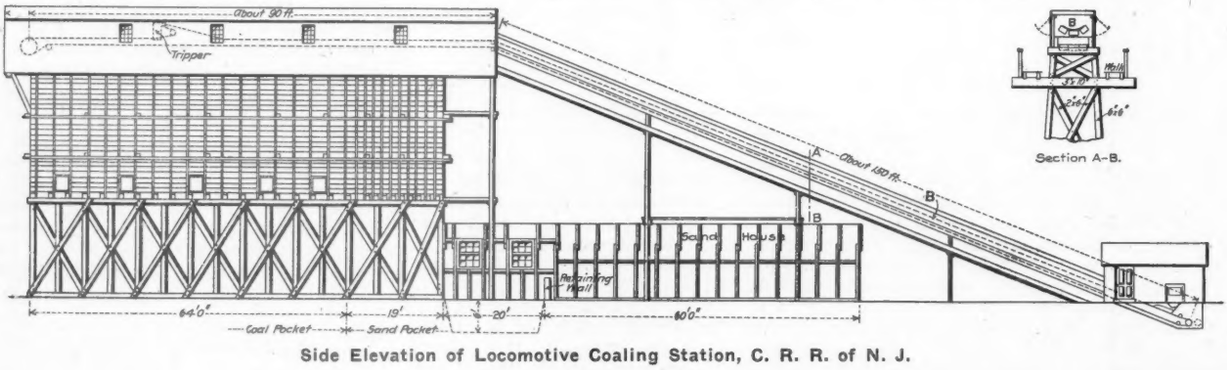


Locomotive Coaling Station—Central Railroad of New Jersey.

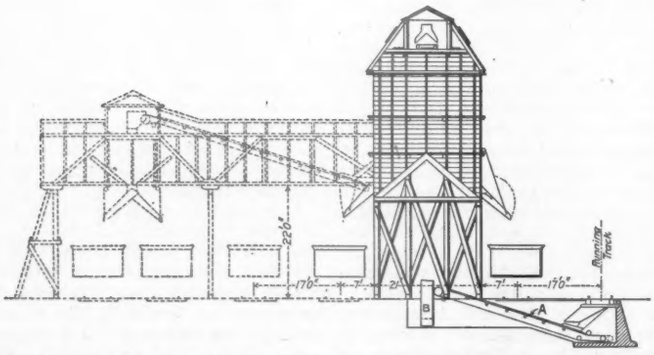
keeps his line at work almost continuously. There are receiving instruments (which substantially serve the purpose of bulletins) in the station master's office, the baggage room, the information bureau, and a number of other places at which prompt information concerning incoming trains is desirable. For each train the number of the track on which it will come in is given in the message. The advantage of this method of communication over the telegraph is in the fact that no operator is necessary at the receiving end; and, as compared with the telephone, there is not only this, and the advantage of accuracy, but the person at the receiving end needs give no particular attention to the apparatus. With a sending operator who writes a clear, legible hand, the apparatus assures clear and legible bulletins at all the receiving stations. The sending operator has a receiving apparatus connected to the line in his own office so that he always sees the record of what he is sending. Any intelligent person who can write can send the messages, and the receiving instrument is self-registering, so that there is no delay if the person at that end is absent from his office.

Locomotive Coaling Station for the Central Railroad of New Jersey.

The Robins Conveying Belt Company, New York, has just completed a 800-ton capacity coaling station for the Central Railroad of New Jersey. The plant is at the Elizabethport shops and is built parallel to the Newark branch road. It is the railroad company's intention in the near future to build a section across this road, as shown by the dotted lines. The building is of timber and consists of one large coal pocket and a sand pocket. The coal pocket has partitions for the division of the several kinds of coal to be stored, and it is provided with eight coal chutes, four on each side of the building. These chutes are of a new design, and are operated from the engine tender. There are two sand chutes, one on each side of the sand pocket. Two 24-in. belt conveyors are used. The belts have a $^{5}/_{16}$ pure rubber cover at their centers. The conveyor "A" is 35 ft. between centers and is driven by a 5 h.p. D. C. Sprague motor. Conveyor "B" is 240 ft. between centers and is driven by a 30 h.p. motor. The coal is discharged from hopper-bottom cars into the track hopper, thence upon a grizzly and thence to a short conveyor which dumps at right angles upon the long conveyor "B," which in turn discharges into any part of the coal pocket desired by means of an automatic tripper. Any



Side Elevation of Locomotive Coaling Station, C. R. R. of N. J.



Cross Section of Coaling Station Showing Proposed Extension, C. R. R. of N. J.

lumps of coal larger than 8 in. drop on to a shaft at the lower end of the grizzly where they are broken up and fall on to the conveyor "A." The troughing, return, and guide idlers are of cast iron and run on hollow cold drawn steel tube shafts. These are lubricated by means of patent compression grease cups mounted on their ends. The tripper is of the Robins automatic reversible type, and can be operated automatically by means of a lever on the side of the tripper and stops placed on the rails, or by hand from either side of the machine, the power being taken from the conveyor belt in both cases. The tripper can also be made to operate in a fixed position by throwing out the automatic attachment and clamping the machine to the rails. The carrying portions

of the belts are kept clean by means of automatic rotary brushes. The driving pulleys at the conveyor ends have extra high crowns and are secured to their shafts by both keys and set screws, as are also the cast iron gears. The track hopper and chutes are of yellow pine lined with steel. The sand pocket is lined inside with Paroid roofing paper, and the floor is of 1½ planks doubled, with roofing paper placed between. The plant is electrically driven throughout, and the speed of the conveyor belt is 377 f.p.m.

A Long Run Without a Stop.

BY H. A. B. CAMPBELL.

On July 1, 1904, the Great Western of England started the running of one train each way per day, between London and Plymouth, 246 miles, without a stop, and the following page taken from the railroad's time-tables shows the running times of these two trains.

Distance from London, miles.		A. M.	Pass., A. M.
..	London ..... Dep.	10:10	....
35	Reading		10:46
53	Didcot		11:03
77	Swindon		11:27
93	Chippenham		11:43
106	Bath		11:56
		P. M.	
116	Bristol (East Depot)		12:06
118	Bristol (Pylle Hill Junction)		10:10
137	Uphill Junction		12:29
162	Taunton		12:53
193	Exeter		1:27
208	Teignmouth		1:46
213	Newton Abbot		1:52½
217	Dainton		1:59
222	Totnes		2:05½
227	Rattery		2:13
231	Wrangaton		2:19
238	Hemerdon		2:28
245	Plymouth ..... Arr.	2:35 P. M.	

Distance from London, miles.		P. M.	Pass., P. M.
245	Plymouth ..... Dep.	12:35	
238	Hemerdon		12:46
231	Wrangaton		12:55
227	Rattery		1:00½
222	Totnes		1:07
217	Dainton		1:13½
213	Newton Abbot		1:19½
208	Teignmouth		1:26
193	Exeter		1:45
162	Taunton		2:16
137	Uphill Junction		2:39
118	Bristol (Pylle Hill Junction)		2:58
116	Bristol (East Depot)		3:02
106	Bath		3:13
93	Chippenham		3:27
77	Swindon		3:44
53	Didcot		4:07
35	Reading		4:24
..	London ..... Arr.	5:00 P. M.	

Such a run is remarkable, because, first, it is done daily by two trains, one up and one down. Second, because for 70 miles of the distance the grades are exceptionally severe. Three, because a high average speed is maintained throughout, namely, 56 m.p.h. This run of 246 miles has been done without a stop with a five-car train at an average speed of 66 m.p.h. On May 9, 1904, with a mail special of five postal cars, the run was made at an average speed of 70½ m.p.h. with one stop to drop a car. Such runs are a proof that the present daily performance is well within the limits of both the locomotives and the permanent way. The following runs are from the company's time-tables of daily trains:

Trains per day.		Miles without stop.	Av. speed, miles per hour.
2	London to Plymouth in 265 mins.	245	55.6
4	London to Exeter in 205 mins.	193	56.7
4	London to Birmingham, 137 mins.	129	56.6
2	London to Bristol, in 120 mins.	118	59.1

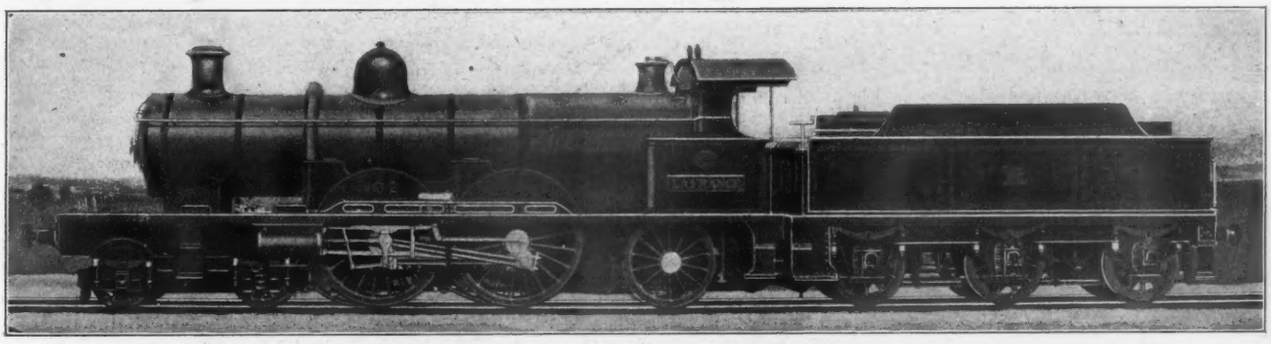
To take up the first run in detail let it be considered as to, first, the roadbed and grades; second, the train and locomotives; third, the running speeds maintained.

The Great Western was built by I. K. Brunel (the designer of the steamship Great Eastern), regardless of cost. Tunnels, viaducts and bridges were used to make the road as nearly straight and level as possible. But in spite of this a glance at the profile of the road will show that it is not level. Starting from London the first 70 miles have a very slight rise. The road then falls on gradients from 4 to 50 ft. to the mile to Bristol. Then follows nearly 40 miles of level running, to be succeeded, however, by a rise of 390 ft. in 10 miles on grades of 30 to 58 and 66 ft. per mile. Then there is a fall of 300 ft. in the next 10 miles to Exeter. But from Exeter on for the remaining 52 miles to Plymouth the road even to an American must be considered mountainous. These are the grades which have to be met.

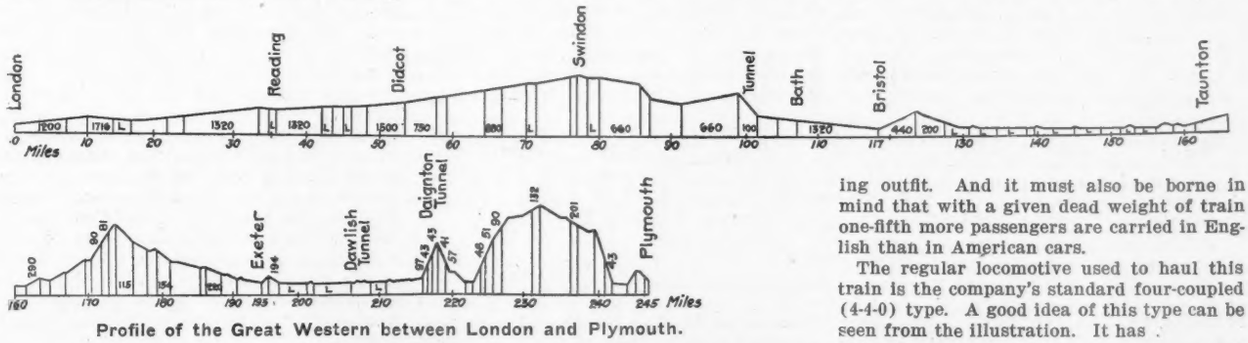
To Plymouth.	Per mile.	*From Plymouth.*	Per mile.
2½ miles.....	66 ft.	1⅝ miles.....	132 ft.
2¼ miles.....	123 ft.	27/10 miles.....	96 ft.
4¼ miles.....	110 ft.	¼ mile.....	71 ft.
1⅓ miles.....	73 ft.	1/10 mile.....	68 ft.

The track is laid with rails weighing 95 lbs. to the yard, 32 ft. long, and with 13 ties to the length. A heavy cast iron chair holds the rail to the tie. The road is stone ballasted throughout, four-tracked as far as Bristol and two-tracked from there on to Plymouth with the exception of the 1½ miles through the five Dawlish tunnels, which is single track. The block system of signals is used throughout, and water troughs are laid at three different points along the road. Each train consists of six cars of the side corridor type, and with vestibules between each car and made up in following order: 1. Composite baggage third. 2. Third class. 3. First class. 4. Dining car (72 ft. long). 5. Second class. 6. Composite third. Excepting the diner the cars are 52 ft. long with steel underframes and carried on four-wheel bogie trucks. The equipment includes steam heat, electric lights and call bells, automatic vacuum brake and pneumatic train signal. The train has a total seating capacity for 200 passengers.

The total weight of the cars loaded is 189 tons, and the gross of engine and train is 283 tons. Such a train is by no means a racing outfit. And it must also be borne in mind that with a given dead weight of train one-fifth more passengers are carried in English than in American cars.



De Glehn Compound Used on the Great Western.



Profile of the Great Western between London and Plymouth.

The regular locomotive used to haul this train is the company's standard four-coupled (4-4-0) type. A good idea of this type can be seen from the illustration. It has

Cylinders (single expansion) in.	18 x 26
Diameter of driving wheels, in.	80
Weight on driving wheels, lbs	75,000
Boiler pressure, lbs	200
Heating surface, sq. ft.	1,800
Grate area, sq. ft.	21½
Tank capacity, Imp. gal.	4,000
Coal capacity, tons	5
Total weight engine and tender, tons	93

As an experiment and for the sake of comparing the work done, the French de Glehn Atlantic type (4-4-2) was put on to haul this train. The illustration shows the engine as adapted to English service and with the company's standard tender. It has

Cylinders, in	13 3/16 and 22 x 25¼
Diameter of driving wheels, in	80
Weight on driving wheels, lbs	71,000
Boiler pressure, lbs.	227
Heating surface, sq. ft.	2,325
Grate area, sq. ft.	29.5

Water capacity, gal 4,000
Coal capacity, tons 5

In running the 246 miles in 265 min. without a stop the following reductions in speed have to be made, and English railroad laws are obeyed to the letter.

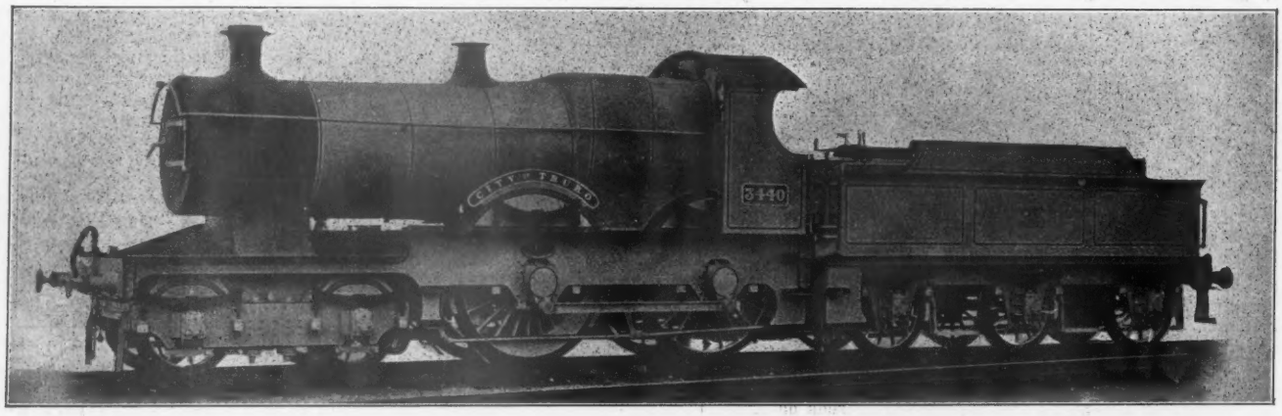
Bath station (curve) .....15 m.p.h.
Bristol avoiding line (s. curves).....10 m. p. h.
Taunton .....15 m. p. h.
Exeter ..... 5 m. p. h.
Dawlish tunnels (single track).....25 m. p. h.

The first six miles out of London are a veritable network of switches. The run may be taken in three ways: London to Plymouth, 246 miles, in 265 min. at an average speed of 55.6 m.p.h.; London to Exeter, 193⅝ miles, in 195 min. at an average speed of 59¼ m.p.h.; Exeter to Plymouth, 52 miles, in 70 min., at an average speed of 44½ m.p.h.

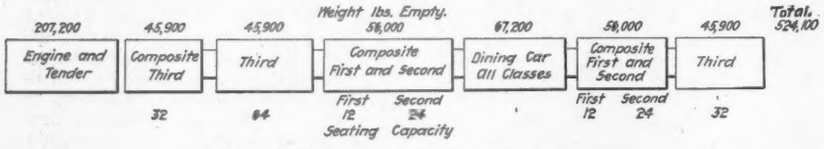
In order to keep up such a high average speed the following logs of the runs of June 30, 1904, and July 1, 1904, will speak for themselves. All speeds are average. The train consisted of six cars hauled by the English built engine. From London to Plymouth, a distance of 245 miles, the time was 264 minutes, or an average speed of 55.8 m.p.h. From London to Exeter, a distance of 193 miles, the run was made in 194 minutes, or an average speed of 59.6 m.p.h. From mile post 5 to 105, a distance of 100 miles, the time was 92 min. 50 sec., or an average speed of 64.6 m.p.h. From mile post 4 to 205, a distance of 200 miles, the time was 200 min. 30 sec., or an average speed of 60 m.p.h. The maximum speed was 75 m.p.h.

From Plymouth to London, a distance of 245 miles, the time was 258 min., or an average speed of 57 m.p.h. From Exeter to London, a distance of 194 miles, the time was 187 min. 30 sec., including a dead stop, or an average speed of 62.1 m.p.h. From mile post 203 to 2, a distance of 200 miles, the time was 197 min. 20 sec., or an average speed of 61 m.p.h. From mile post 97 to 6, a distance of 91 miles, the time was 77 min. 55 sec., or an average speed of 70 m.p.h. The maximum speed was 81 m.p.h.

The fact that one locomotive hauls 289 tons for 245 miles without a stop, and at speeds but little below those maintained by the world famous Camden-Atlantic City trains, shows that the locomotive must be considered a fine machine whether built in England, America or France.



English Built Express Locomotive—Great Western.



Plan of Make-up of Train—Great Western.

Early Transportation in New York.

BY HENRY E. ARMSTRONG.

Between 1682, when Gov. Stuyvesant died on his farm, "the Great Bouwerie," and the Revolution, the growth of New York was slow for a city of its destiny. There was an average increase of population of only 150 a year. In 1774 a census taken by the authorities showed a total of 22,861 souls. Not until after the War of Independence do we find passenger transportation on a commercial basis. In 1783 the rate for a carriage ride from the Battery to Murray Hill was fourteen shillings—about two dollars and a half. For two shillings more the traveler could reach Gracie's Point, opposite Hell Gate. For the same amount, 16 shillings, he might go up to Apthorpe's, on the west side of the island, about where Ninety-second street is now. The journey to Harlem was a day's excursion and cost 38 shillings. When the Subway is open for traffic the New Yorker of 1904 will be able to go to Kingsbridge in half an hour for five cents.

The first serious effort to furnish transportation in New York was the stage line which was put on between Bowling Green and Bleecker street in 1830. Competition soon became brisk. Coaches in all the glory of high colors, and embellished with portraits of celebrities, traversed the city from river to river, and from the point of the island, where the Aquarium (formerly Castle Clinton) stands to-day, to Greenwich Village and Yorkville. The most pretentious stages were drawn by four horses and bore such honored names as Lady Washington, George Washington, and De Witt Clinton. New York still boasts a line of busses on Fifth avenue, and the sight of them in an age of electric traction carries the mind back to a day when the Post Road to Boston ran through Madison Square, and what is now Central Park was sacred soil, wantonly wild and famous for the revolutionary relic of McGowan's Pass.

Seven years before Madison Square was laid out, or in 1831, a great stride was made in transportation by the introduction of the horse-railroad. In that year the New York & Harlem Railroad Company was organized. The pioneer of all street cars, the John Mason, named for the founder of the Chemical Bank and the first president of the world's first horse-railroad company, made its initial trip between Prince and Fourteenth street on Nov. 26, 1832. It carried the Mayor and Common Council of the city and John Stephenson, the builder. When the subway of the Rapid Transit Construction Company is opened to traffic the occasion will be a red-letter day in the history of urban transportation, but it will not arouse and interest the people of New York as did the passage of the first horse-car through the streets, in 1832.

After the Civil War, when the city began to spread north of Central Park, which had been laid out in 1856, it became evident that the horse-car service was behind the times. The Hudson River Railroad landed its passengers at Thirtieth street and Ninth avenue, it was true, and the New York & New Haven and the Harlem railroads had termini in the neighborhood of Madison and Fourth avenues and Twenty-sixth street, but to avoid accidents trains had run as slowly as the horse-cars. Agitation for quicker transportation to the foot of the island resulted between 1868 and 1870 in the incorporation of two underground railroad companies. One of them built an experimental section beneath Broadway from Warren to Murray street. The excavation was made by a shield forced ahead by hydraulic pressure. Into the tunnel was introduced a steel casing 8 ft. in diameter, which was to hold a car as the piston fits in the cylinder. By powerful fans the car was to be blown on its way. This novelty was known as the Beach pneumatic road. A public exhibition was set for April 26, 1870, and 18 daring men crowded themselves into the car and were pushed majestically from Murray to Warren. The company boldly announced that it would build 100 cars and soon have them running from the Battery to Harlem. But that hole in the ground was soon abandoned, and the ambitious scheme to shoot business New York to Harlem pneumatically came to nothing.

Then there was the Arcade Railway, a picturesque idea that was never put into effect. The tracks were to be laid in a long arcade over the sidewalk the length of Broadway; but property owners along the route vigorously objected, and the promoters, calculating that the expense of construction would be altogether too great for a dividend-payer, withdrew the scheme. A Viaduct railroad to run through private property and cross intervening streets on substantial bridges shared the same fate. Another project, the Greenwich Street Elevated Railroad, begun in 1866, had better luck; but never were promoters more abused or their public-spirited prospectus more derided. One

is reminded of the famous protest of Admiral Sir Isaac Coffin when the application for a charter for the Liverpool & Manchester Railway was before the House of Commons. "Was the House aware," asked that fine old Tory, "of the smoke and the noise, the hiss and the whirl which locomotive engines, passing at the rate of 10 or 12 miles an hour, would occasion? Neither the cattle plowing in the fields, nor grazing in the meadows, would view them without dismay. Iron would be raised in price 100 per cent. or more probably, exhausted altogether. It would be the greatest nuisance, the most complete disturber of quiet and comfort in all parts of the kingdom that the ingenuity of man could invent."

But the promoters triumphed in spite of the Manhattan Coffins of 1866. A one-track road was built from Battery Place through Greenwich street, and on July 2, 1867, New York was invited to ride on an air-line operated by cables. Although steam locomotives were soon substituted the first elevated railroad in New York had a hard time of it. Damned up-hill and down, the butt of newspaper wits, and neglected by the traveling public, it struggled along against contumely and ingratitude until the sheriff got it. That was in 1871.

The legislature was asked at the session of 1872 for two rapid transit charters. Dr. Rufus H. Gilbert, the applicant for one of them, proposed to suspend a pneumatic tube from lofty arches, and very much on the principle of the Beach device cars were to be slid through it noiselessly. The roaring and grinding and creaking of the Greenwich street elevated trains was the chief objection to them. New York is not so sensitive to noise now. A steam railroad built up at the sides to save the modesty of second-story tenants was substituted for the fantastic plan of Dr. Gilbert, and then there was a return to the elevated railroad on Greenwich street. The legislature of 1875 tackled the irrepressible problem again, passing the Husted bill for the appointment of a commission to decide as to the necessity (!) of rapid transit in New York, and, if it existed, to propose desirable routes. A commission of Joseph Seligman, Louis B. Brown, Cornelius H. Delamater, Jordan L. Mott, and Charles J. Canda, recommended on July 13, that elevated steam railroads be built upon Second, Third, Sixth and Ninth avenues, and invited the Gilbert Company and the New York Company, the latter at the time operating a none too robust elevated road on Greenwich street, to enter upon the work of construction. Before the end of 1876 the New York Company (now the Ninth avenue line), although assailed on all sides by litigants with extravagant damage claims, had pushed its tracks up to Fifty-ninth street, and was advertising "40 through trains" a day. Cyrus W. Field, the Atlantic cable magician, invaded the rapid transit field in 1877, and bought a controlling interest. By June 5, 1878, the Sixth avenue road was in operation from Rector street to Central Park. The West Side lines were consolidated under the name of the Metropolitan Elevated Railroad. The Third avenue line was operated as far as Forty-second street on August 26. It was 1880 before the Second Avenue reached Sixty-seventh street, but by the end of that year the elevated roads on both sides of the city, later known as the Manhattan Railway Company, had been extended to Harlem.

Some years before this there had been another consolidation, and a public work was completed which accomplished great things for rapid transit. That was the assembling of the downtown stations of the Hudson River, New York & New Haven, and Harlem companies at Forty-second street under the colossal dome (for 1871) of Cornelius Vanderbilt's Grand Central terminus. Four years later the railroad tracks were shut in or removed from the streets below the Harlem River by tunnel and stone viaduct, an engineering work which cost $6,000,000. Half the expense was borne by the city.

After the completion of the fundamental lines of the east side elevated roads, in 1879-1880, there was no progress of especial interest in New York rapid transit until the Broadway horse-car line was equipped with a cable, in 1892, to serve only a scant six years before its removal and the substitution of the conduit system of electrical traction, in 1898. But surface cars on the crowded streets could furnish rapid transit only in name, although materially aiding in handling the crowds, and the demand for fast time from the residence part of town to the business section was so great that before the Ninth avenue elevated road had been open a year, it was reported in the *Railroad Gazette* that people had to be "turned away" during the rush hours, from stations north of Warren street. So far as real rapid transit is concerned, therefore, there is a gap of 24 years—from 1880 to 1904, in the provision of new facilities for getting from one end of Manhattan Island to the other.

History and Physical Aspects of the New York Subway.

[WITH AN INSET.]

In 1894 was created the present Rapid Transit Commission—it had two predecessors which fizzled out without accomplishing anything. The Mayor, Comptroller, President of the Chamber of Commerce and five citizens named in the enabling act were authorized to sell a franchise to a private corporation, or to engage in municipal construction, as the voters should decide. They declared for the latter method overwhelmingly. The Commission, consisting besides the Mayor, Comptroller and President Charles S. Smith, of the Chamber of Commerce, of Alexander E. Orr, Woodbury Langdon, Morris K. Jesup, George L. Rives and John H. Starin, selected a route, made surveys, prepared plans for an underground railroad, estimated cost, and called for bids. Mr. Andrew Onderdonk offered to build and equip the road for $39,300,000, and Mr. John B. McDonald underbid him by $4,300,000. The bid of Mr. McDonald, whose fitness for the undertaking was attested by his construction of the great tunnel for the Baltimore & Ohio Railroad under the city of Baltimore, was accepted. There was hardly a dollar's difference between his bid and the estimate of Mr. William Barclay Parsons, the Chief Engineer of the Commission, who had made 6,000 borings to determine the nature of the soil in which the subway must be built.

The quarter of a million passengers transported to the business district by the elevated and surface cars during the morning rush have been thus accounted for: 75,000 come down from above Twenty-third street by the four elevated lines and 67,000 by the surface electric roads; 31,000 are brought from Long Island and Staten Island by the ferries, and 33,000 cross on Brooklyn Bridge cars to resume their journey in Manhattan Borough; New Jersey contributes 32,000, and 12,000 reach the Broadway and avenue cars by cross-town traction. Consider that 50 per cent. of these passengers have to stand in the cars, enduring the greatest discomfort. To suppose that when the subway is running seats will be found for all who desire to ride is to be blindly optimistic. As for the surface cars, they will be as congested as ever, since they cannot handle long-haul traffic now and do not want it.

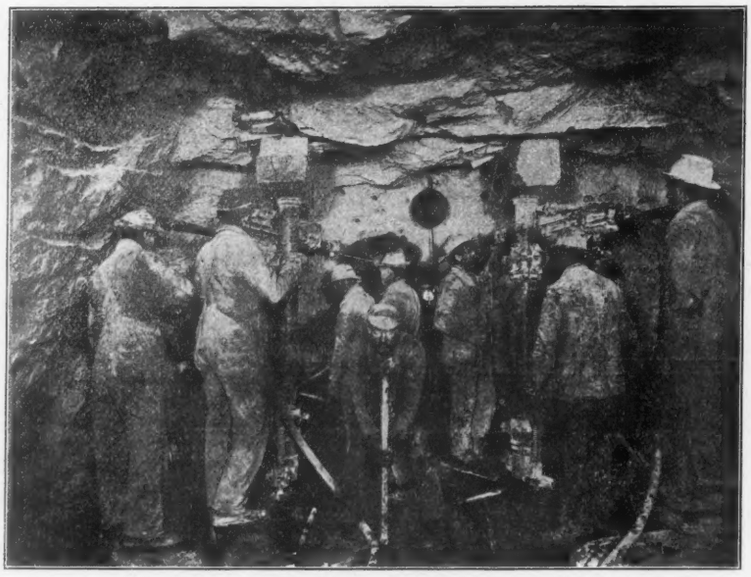
But though it be a foregone conclusion that the Rapid Transit Railroad of Manhattan Island and Bronx Borough, in view of the constantly increasing traffic, will fail to solve for any considerable time the vexed problem, let us make no mistake about the greatness and grandeur of the undertaking, the difficulties to be overcome in building it, and the incalculable service it will render the community. The contract between the Rapid Transit Commission and Mr. John B. McDonald was a document of 55,000 words. For the personal performance of his agreement he had to deposit $1,000,000 in securities with the Comptroller of the city, and also to file with him a $5,000,000 bond with sureties for the construction and equipment of the road. The main line was to be seven miles in length, and it was to have two branches each of seven miles. In the course of the work not less than 1,700,288 cubic yards of earth would have to be excavated, 773,093 to be filled back, 921,128 of rock to be excavated and 368,606 to be tunnelled. The steel to be used in construction was reckoned at 65,044 tons, the cast iron at 7,901, concrete 489,122 cu. yds., brick 18,519 cu. yds., and the waterproofing 775,795. Forty-three local and five express stations would have to be built and ten passenger elevators.

The contractor agreed to build the road without stopping street traffic or damaging the labyrinth of electric conduits, sewers, water mains, gas and steam pipes and pneumatic tubes below the surface of the ground. Considering the enormous difficulties which everywhere confronted him, he has been very successful in this, although there has been serious congestion of traffic at times. He was to shore up buildings, protect monuments, support street railroad tracks, keep one side of the street open, afford access to hydrants and fire alarm boxes, and to replace each tree belonging to the city which was cut down. It became necessary to move gas and water pipes and electric conduits, and to lower sewers and to make new connections. A sewer at Canal street, nine feet by six, which drained many hundred acres into the Hudson River proved such an obstacle in the path of the tunnel that a new sewer draining off to the East River was built at great labor and expense, the old one being abandoned.

Owing to the opposition of property-owners on Broadway the route avoids that thoroughfare below Forty-second street. It begins with a loop at the post office and runs under Park Row, Center street, New Elm street, Lafayette Place, thence to Fourth and Park avenues, to Forty-second street opposite the Grand Central Station, under that street west to Broadway, and under Broadway to 104th street. There are four tracks to this point, but here the road forks, two tracks running under and over Broadway to Kingsbridge, and two running east to Central Park, passing under the northwest corner of it to Lenox avenue, continuing to 141st street, tunneling under the Harlem river, and finally running through Bronx Borough to Bronx Park and the Zoological Gardens.

The heaviest tunneling on the Subway is the passage through a hill of gneiss from 158th street to the vicinity of Fort George. This tunnel is approximately two miles long, and next to the Hoosac on the Fitchburg railroad in Massachusetts, the longest tunnel in the United States. The drilling machines were supplied with compressed air by a plant on the bank of the Hudson. Two passenger elevators give access to the tracks at this point, and the lift of each is approximately 100 ft. below the surface. But for great stretches the Subway road will belie its name, running on a viaduct across Man-

hattan valley between Bloomingdale and Washington heights, and as an elevated road on the east side from 149th street to the terminus, and on the west side from 125th street to 133rd, and from Fort George to the end of the line. For miles on Manhattan Island it is a covered-in-trench, and not a tunnel, with glass-roofed and therefore well-lighted stations at short intervals. Of the Rapid Transit railroad's total length of 21 miles 5.14 miles will be carried on elevated structures and one-half mile on a steel viaduct. The inner two of the four tracks south of 104th street are to be used for express service, trains running 30 miles an hour and stopping at stations a mile and a half apart. Thus, for the express trains, it will be a trip of 14 to 18 minutes to the end of the main line, including stops. The speed of the locals will be about 14 miles an hour, and there will be four way-stations to the mile. Every express station is connected with the way-station by bridges, so that passengers may change from one train to another, as suits their convenience. As the four tracks approach, the outer ones on each side will curve enough to allow space between them and the middle pair of tracks for an "island station"; the stations for way trains will be on the outside of the system



Rapid Transit under Difficulties.

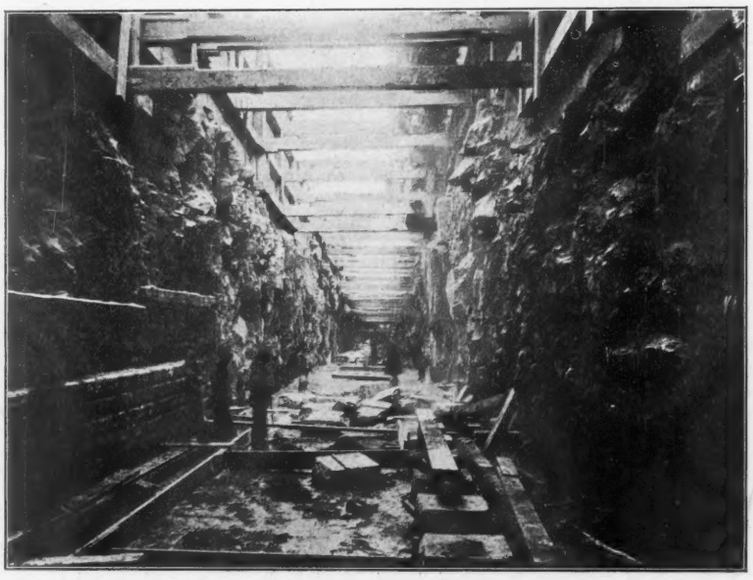
Method of Supporting Street Car Tracks (Right of Picture).

of tracks. The west side branch above 104th street is to have the use of a third track as far as 145th street, which was not in the original plan. The Commission having recommended that between 137th and 145th streets a side-track be built to accommodate cars in the storage shed, it was decided to extend the track south to 104th. It will be used for express service during rush hours.

The most difficult part of the work next to the piercing of the rock ridge near Fort George, was the passage of the Harlem River by the eastern branch at 145th street. The stream here is 900 ft. between bulkhead lines; the greatest depth is 20 ft. below low-water mark. Two tubes, 15 ft. in diameter, and lined with cast-iron imbedded in concrete, were laid almost flush with the river bottom. The tubes were sunk by the caisson method in sections to avoid interference with navigation. Just as one side of a street was left open for traffic, so there was always room on the Harlem for river craft.

The accompanying paper on the London tube road illustrates the contrast in the materials with which the engineers had to work. The London blue clay offered no problems like the rock, clay, sand and quagmire of the New York subway. There are three styles of section in the subway proper: the rectangular for the covered-in-trench, the barrel-vault for tunnels, and the circular, or tube, where the tracks go under the Harlem river. When the excavation for the trench had been made to a depth of 20 ft., a floor of concrete was laid. Upon this, at intervals of five feet, riveted steel beams were erected to carry the weight of the street surface and to resist the side pressure. Between these ribs a wall of concrete was built. Cross-pieces for the roof are joined to the uprights and similarly treated with concrete. Imbedded in the concrete at the sides, above and below, are alternate layers of felt and asphalt to keep out moisture.

The accompanying illustrations show a number of characteristic stations. The City Hall station, the present southern terminus until the extension to the Battery is completed, has a platform 200 ft. long by 14 wide, reached by curving stairways from east and west. The ceiling is divided into semi-circular arches, giving a dome effect. The station is decorated in the Romanesque style with colored tiles, and light-wells. The contract contained the stipulation that, as the railroad and equipment constituted



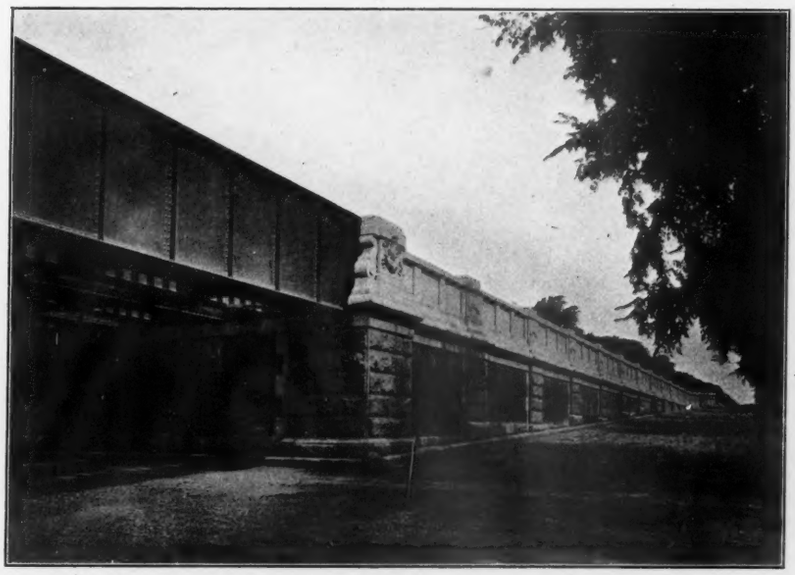
Deep Rock Cut, Forty-Second Street near Fifth Avenue.

City Hall Station.

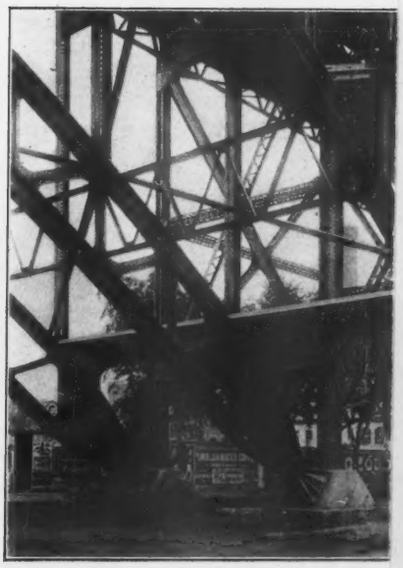
The Astor Pl

Relation of Covered Trench to Street Surface.

Subdivision of Gas Mai



North End of Manhattan Valley Viaduct.



Skew-Backs of Steel A

ace Beavers.

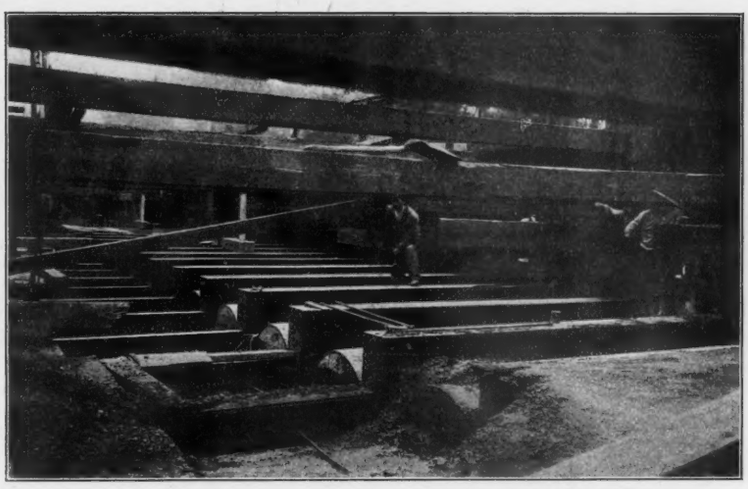
Twenty-eighth Street Station.

s at Sixty-sixth Street.

Cut-and-Cover Construction for the Tube Tunnel under Central Park.

Arch over 129th Street.

Viaduct North of Fort George.



Finishing Roof, Cut-and-Cover Section.

a great public work, all parts of the structure where exposed to public sight should be designed with a view to the beauty of their appearance, as well as to their efficiency.

By the terms of the contract Mr. McDonald is to equip the road as well as to build it, that is to say, he must furnish motors, engines, passenger cars and all rolling stock, electric power, conduits, wires, mechanism, and apparatus for lighting, signaling and ventilation. When built and equipped, he is to operate the road under a lease from the city for a term of 50 years, every year paying a sum equal to the interest on the bonds issued for construction and a further annual sum for a sinking fund equal to 1 per cent. upon the whole amount of the bonds. At the end of 45 years the principal can be retired by the accumulations in the sinking fund. By giving notice of not less than one year before the expiration of the lease Mr. McDonald, or his assigns, may claim an extension of 25 years. By this financial arrangement the city ultimately comes into possession of the subway, but it must buy the equipment from the contractor, or from the operating company.

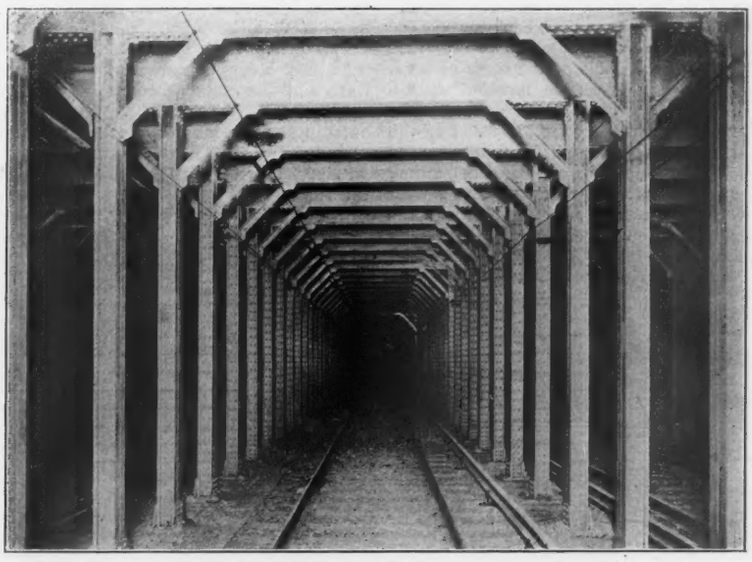
Mayor Van Wyck began the work of construction in front of the City Hall on March 24, 1900, by turning up a spadeful of earth. The road was to have been completed by Sept. 24, 1904, and in all essentials it was completed some time earlier, except for some minor details and a general "tuning up." Both Mr. McDonald and Chief Engineer William Barclay Parsons indulged the hope at one time that it would be open for traffic to the end of the main line by Christmas, 1903, but they had left labor troubles out of their reckoning. Five months were lost by strikes on the power house at Fifty-ninth street and Eleventh avenue, and the rockmen and excavators have proved a very uncertain quantity. Up to May 1, 1903, four-fifths of the excavating had been done and more than half of the rock had been blasted. On Fourth avenue from Tenth street to Thirty-third the Subway was completed and ready for the rails, although the stations at Fourteenth, Twenty-third and Thirty-third streets had not been built. On Broadway from Forty-seventh to Sixtieth streets the tracks were down and men were whitewashing the subway walls. Under Elm street the work was practically finished. The City Hall loop had been completed and the switches under Park Row. The tunnel under Central Park was ready for the rails, as was the Lenox avenue section between 110th and 135th streets. Foundations for the elevated pillars in Manhattan valley were down.

As many as 10,000 men have been at work on the Subway, in day and night shifts, at one time, including engineers, machinists, riveters, carpenters, masons, calkers, drill-runners, diggers, blasters, and teamsters.

Traffic Features of the Subway.

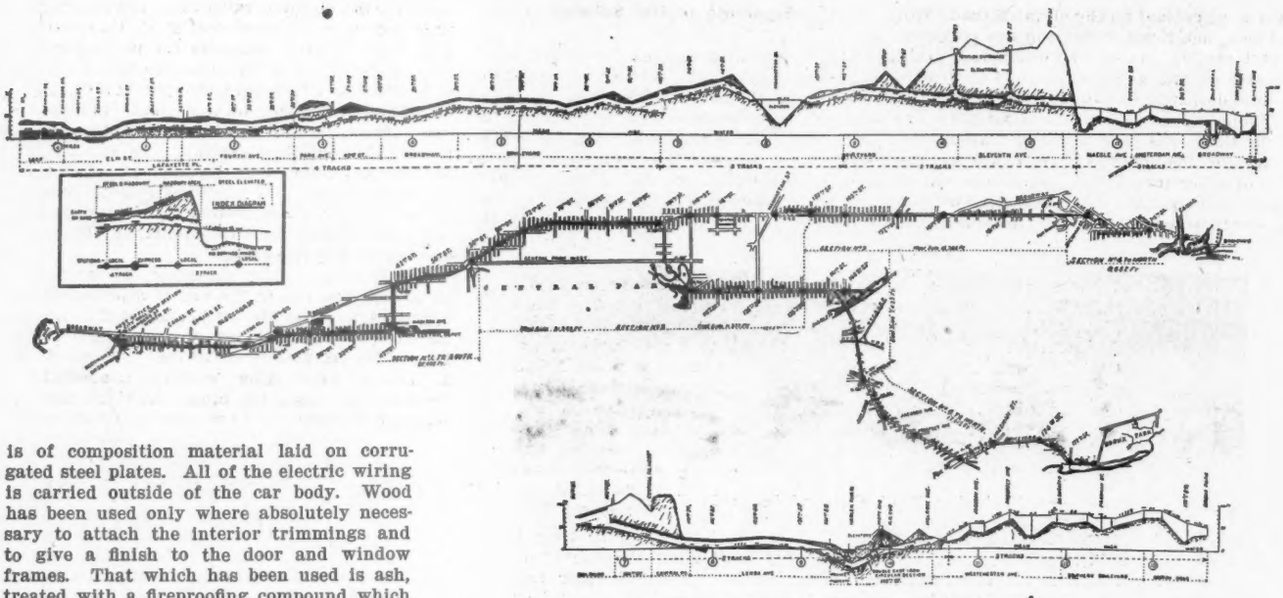
At the present time, instruction trains are being run through the New York Rapid Transit Subway from 145th street as far south as the present terminus at City Hall. There remains still to be done some work at the stations and a considerable amount of harmonizing and adjusting of all the parts of the transportation machine, and October 1st is the earliest date at which the subway is likely to be open for general public use. There is still much uncertainty with regard to many of the operating details. It is not known how many cars will ultimately be required to maintain the desired local and express services, although it is proposed to start with about 600, and there is a similar uncertainty with regard to the make-up of the trains. Eight cars will probably be the maximum.

At the start, it is probable that about 40 local and 25 express trains will be run north as far as 145th street on both the east and the west sides. The cars will be more fully described and illustrated in a subsequent article. It is sufficient here to say that they are as nearly fireproof as it is possible to make them. All of the body, roof and underframing is steel and the sides and roof are sheathed with thin steel plates. The floor



Interior View, Cut-and-Cover Section.

Manhattan Valley Viaduct, Broadway and 129th Street.

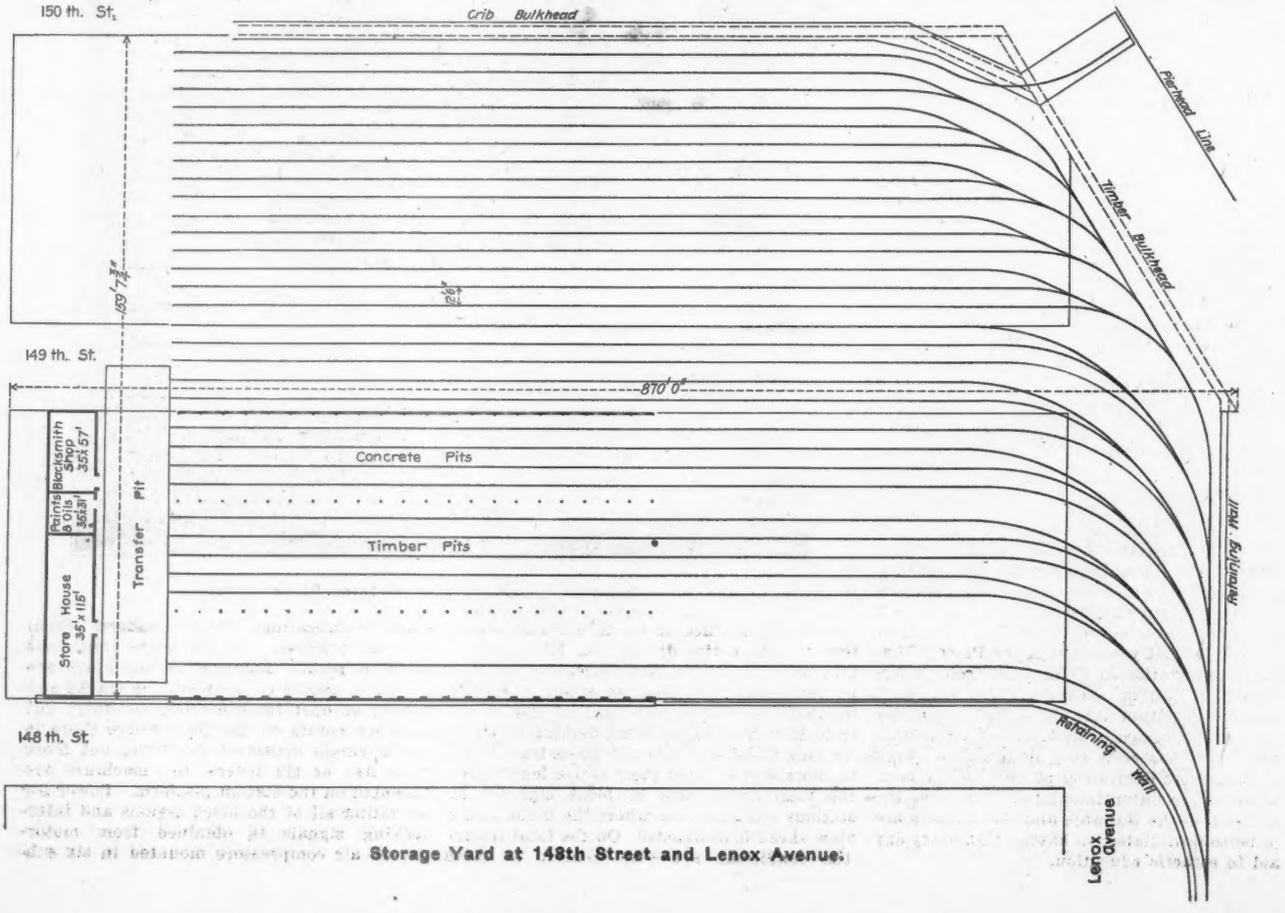


Plan and Profile, Rapid Transit Subway.

is of composition material laid on corrugated steel plates. All of the electric wiring is carried outside of the car body. Wood has been used only where absolutely necessary to attach the interior trimmings and to give a finish to the door and window frames. That which has been used is ash, treated with a fireproofing compound which makes it practically incombustible. The seats are rattan and are arranged part longitudinally and part across the car in the same way as in the cars now used on the elevated railroad. The platforms are enclosed but the entrance doors on each side are 10 in. wider than the entrance gates of the elevated cars, so that passengers can be handled at stations quicker and with less crowding. The car bodies alone cost about $3,600. For the present these steel cars will be supplemented by a large number of copper-sheathed wooden cars which were originally bought with the intention of running them in the subway but which have been supplanted as the standard design by the more substantial steel cars. About 600 of these cars are owned by the Interborough, and for the past year some of them have been running on the elevated lines. They are interchangeable both with the older equipment of the elevated lines and the steel cars of the subway, and can be used on either line. When the large outstanding orders for steel cars are completed, however, these copper-sheathed cars will probably be withdrawn from service in the tunnels.

Slightly larger than the cars now in use on the New York elevated lines, the seating capacity of these subway cars will be about 52, and the loaded capacity, with the aisles and platforms filled with standing passengers, is supposed to be 110, although it has never been apparent that there was any particular limit to the number of passengers that could get on a train on the elevated road during rush hours.

Details as to the time-table and running time are not yet available, but it is expected that the express trains, making three intervening stops, will run in about 14 minutes from City Hall to Ninety-sixth street, a distance of approximately seven miles. The station arrangements will, in general, be the



Storage Yard at 148th Street and Lenox Avenue.

same as at present on the elevated road, with two men, one ticket seller and one collector, at each station. There will be about 18 train despatchers and assistant train despatchers, and the despatching will be done entirely by telephone. The duties of despatchers are chiefly those of a yardmaster or trainmaster, orders for the movement of trains on the time of other trains being, of course, unnecessary on a road of this character. The storage yards, where the trains will stand when not in service, will be located at 148th street and Lenox avenue and at 133d street and Broadway. The accompanying plan shows the arrangement of the 148th street yard.

Exits Distinguished From Entrances by Style of Roof.

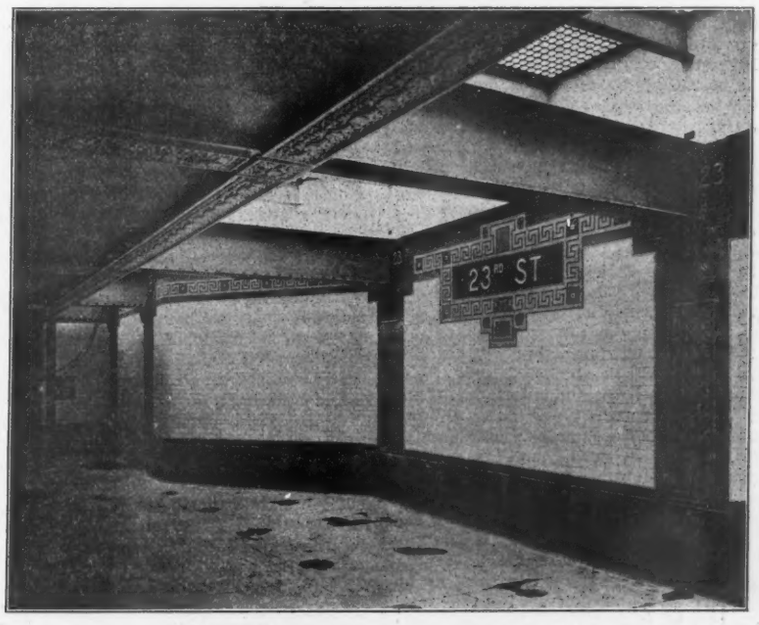
One of the most interesting features of the subway work is the excellence of the stations, especially in comparison with those of the old London underground road, and the Paris Metropolitan. The covered cut style of excavation which prevails for most of the distance permits the stations to be quite perfectly lighted and ventilated, and the electric lights for the stations are entirely independent of the main power as well as of the circuits which operate the signals. In case of accident, the main power can be shut off on a signal given by pressing a button; and there are buttons for this purpose at the stations and also at intermediate points along the route. These can be used at any time without affecting either the block signal circuit or that of the station lamps. Care was also taken to make the individual stations distinctive, to serve more fully as landmarks, and considerable ingenuity has been shown in the scheme of decoration, as will be seen in the accompanying photographs. There was a fine opportunity here for good decorative work and the architects fully availed themselves of it. The photograph of the tablet and decorations marking the Astor Place station is characteristic, and the flat-tailed beavers on either side of the name of the station, and, indeed, appearing wherever there seemed to be a good place for a tablet, will prevent New Yorkers from forgetting that the Astor family made their money in the fur trade of the Northwest. Besides their excellent artistic effect the shields with the beavers are perfectly distinctive, occurring nowhere else in the subway decorations, so that if you see a beaver out of your car window you may know that you are at Astor Place. Similarly, the station at Columbus Circle is decorated with little caravels under full sail, and at the station near Columbia College the seal of the college is made use of. Practical New York has seen very little of this kind of suggestive decorating of such purely businesslike and unsentimental structures as the stations in the Subway, and the citizens are to be congratulated on having this every-day aid to esthetic education.

Signaling in the Subway.

The system of automatic block and interlocking signals in the subway is one of the most complete installations which has ever been made. Between 96th street and the City Hall, there are four tracks, two of which will be used for local trains stopping at all stations, and the other two, which are in the middle, will be used for through express train service in both directions. Between 96th street and 145th street, there are three tracks, two of which will be used for local trains and the third track, which is in the middle, will be used for express trains which will run in one direction only, going down in the morning and up at night. Beyond 145th street, on the West Side division, there are but two tracks, which will be used only for local trains. These tracks run on the surface or on an elevated structure for the entire distance to Kingsbridge. The train service on the express tracks will be very similar to that on steam railroads in that the trains will run at speeds of from 35 to 45 miles an hour, making no stops for long distances. These express tracks will be block signaled for their entire length and the local tracks will be block signaled at stations and at curves where the motorman's view ahead is obstructed. On the local tracks the conditions are very similar to those found on the elevated railroads. Trains are supposed to be under control at all times so that there is little necessity for putting in a block-signal system on these tracks. Such a system has never been thought necessary or advisable on the elevated lines and the same reasons which have prevented its use there, hold good in the subway. In addition to the automatic block signals, all of the junction points and crossovers from one track to another are protected by interlocking signals and switches similar to those used on steam railroads.

The distinguishing feature of the block-signal installation is the use of alternating current track circuits for actuating the signal relays. The rails act as return feeders for a 500-volt power circuit and also carry a 10-volt alternating current connected through the insulated blocks and the signals which control train movements on those blocks. On account of the limited clearances and the conditions of night which prevail in the tunnel the signals indicate by color at all times and not by position. The movement of the colored glasses which show the indications is accomplished by air cylinders operated through electro-pneumatic valves connected with the signal relays, this portion of the apparatus being practically a duplicate of that used in the Westinghouse electro-pneumatic system on steam railroads. The signal lamps are lighted by electricity taken from a separate circuit. On the elevated and surface portions of the line the signals have semaphore blades for use by day and the usual colored glasses for indicating the position of the signal by night. The operating mechanism for the signals in the tunnel and on the surface is the same.

All of the interlocking signals and switches are operated by the Westinghouse electro-pneumatic system with only very slight modifications from standard steam railroad practice. At the more important junction points, interlocking machines are placed in cabins set between the tracks and having an operator constantly on duty; but at other points on the line, where there is but a single crossover requiring not more than five or six levers, the machines are mounted on the station platform. Power for operating all of the block signals and interlocking signals is obtained from motor-driven air compressors mounted in six sub-



Natural Lighting, Twenty-third Street Station.

stations located at distances of about two miles apart.

Every block signal has, as an auxiliary, an automatic stop so arranged that if a motorman overruns a home signal the train is stopped before reaching the *next* home signal, the overlap principle being used to give this distance to stop in.

The entire installation was designed and built by the Union Switch & Signal Company under the direction of Mr. George Gibbs, Consulting Engineer for the Interborough Rapid Transit Company.

The Power Equipment of the New York Subway.

All the power for operating the New York rapid transit subway will be generated at a central power station, which occupies the block between Eleventh and Twelfth avenues and Fifty-eighth and Fifty-ninth streets. The power-house is 609 ft. x 201 ft., and there is room for future extensions. The power plant is divided into six sections. The first five sections are alike with the exception of the fourth, which has steam turbines. The equipment of each of the other sections consists of two main engines with condenser sets, circulating pumps, two boiler feed pumps, two feed water heaters, two air pumps, 12 boilers and one stack, and provision is also made for the installation of four economizers. The turbine section contains one large engine and is also designed for accommodating four 1,250 kilowatt steam turbines. This section also contains two 250 kilowatt steam driven exciter units, three 250 kilowatt motor-driven exciter units, and other accessories. The equipment for the sixth section has not yet been decided upon. The 60 boilers are on one floor on both sides of a 20 foot passage-way. The boilers were built by the Babcock & Wilcox Company, and each contains 6,000 sq. ft. of heating surface and 100 sq. ft. of grate surface. Each battery is connected by means of four smoke uptakes to a horizontal flue, three batteries connecting to two such flues. The arrangement is such that the gases may be passed through economizers. Each section of six boilers is provided with two engine-driven mechanical-draft fans which deliver air under the grate.

The stacks are in the middle of the passage between the boilers and are supported on steel columns. The bases of the stacks are on a level with the bottom of the coal bunkers, and hence do not extend down into the boiler-room. This method of building stacks is new. Each stack is about 120 ft. high and 15 ft. in diameter at the top, and is the Alphons Custodis type. The coal bunkers are above the economizer floor and between the stacks. Seven bunkers are provided so that different grades of coal may be used if desirable. The maximum storage capacity of the bunkers is 16,000 tons. The coal supply is delivered from boats, which land alongside a pier built at the foot of Fifty-eighth street. Here the coal is unloaded, crushed and delivered to a small building near the pier, from which it is loaded on a belt conveyor, which carries it through a tunnel to the power house, from which point it is elevated by belt conveyors to the distributing conveyor which passes over the bunkers. The coal conveyors were built by the Robins Belt Conveyor Company. Most of the boilers will be fired by hand. Some of the boilers are fitted with superheaters. The ash cars under each row of boilers are hauled by electric storage battery locomotives to a conveyor at the water edge which elevates the ashes to a large pocket from which they are discharged into a scow.

The main engines have a rated capacity of 7,500 h.p. and are capable of developing 50 per cent. overload. The engines are twin compound type. The high-pressure cylinders are 42 in. in diameter and the low-pressure cylinders are 86 in. in diameter. The stroke is 60 in. and the speed is 75 r.p.m. The generators were built by the Westinghouse Electric & Manufacturing Company. They have a capacity of 5,000 kilowatts each and furnish three-phase alternating current at 11,000 volts and 25 cycles per second. The steam turbines are the Westinghouse-Parsons type and are direct connected to 11,000 volt, 1,250 kilowatt, three-phase, 60 cycle generators. All motors and generators are connected to the switchboard, which is in a switching room on the Fifty-ninth street side of the building. The operation of all the electrical apparatus is controlled from this point. It is estimated that the cost of the power station will be $7,000,000 when fully equipped. When all the units have been installed and the station is working to its full capacity, the combined power will be 120,000 h.p.

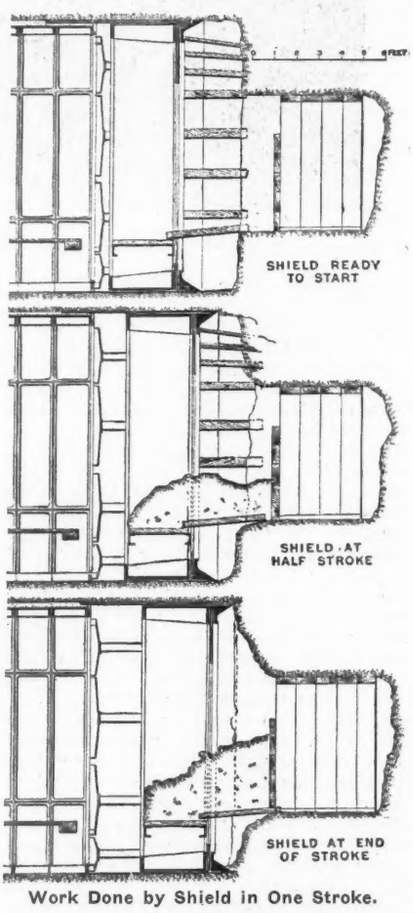
About 600 motor cars will be required for the opening of the line. The Westinghouse multiple control system will be used, three cars out of five, or five cars out of seven or eight in a train being motor cars. The cars for both local and express service will be similarly equipped. The motors were specially designed as it was necessary to have a great deal of power in a limited space. Each motor is rated to use 300 amperes at 570 volts, which is equivalent to 200 h.p. The motor will carry 500 amperes without injurious sparking. The motors are encased but are designed so that easy access can be gained to the interior for inspection and repairs.

Tunneling With a Shield in London Clay.*

The underground electric railroads or "tube" railroads in London have nearly all been driven through the stiff clay which underlies the ground by the Greathead shield method without air pressure. The Greathead shield consists of three principal parts, the cutting edge, the skin and the cylindrical jack casting. The cutting edge is of cast steel made in three parts bolted together and is of slightly larger diameter than the skin of the shield in order to facilitate the progress of the shield through the clay. The skin consists of a cylinder 6 ft. long made up of ½-in. steel plates in three sections with butt-joints and ½-in. cover plates extending from the cutting edge, to which it is fastened with countersunk setscrews, to within about 2 ft. 9 in. back of the jack-castings, forming what is known as the tail of the shield. The object of the tail is to support the ground above and protect the miners while erecting the tunnel lining rings. The ring of jack-castings is made in six sections bolted together and also bolted to the skin and cutting-edge with hardwood packing inserted in the horizontal joints. Besides affording a firm foundation for the jacks these castings greatly strengthen the shield and are indeed its main support. Between the jack-castings and the cutting-edge is a steel diaphragm consisting of two ½-in. plates which give stiffness to the shield and assist in maintaining its circular shape.

The shield is driven forward by eight hydraulic rams or jacks, each 7 in. in diameter, the required pressure being obtained with an air intensifier which is fixed to the shield. This receives air at a pressure of 60 lbs. per sq. in. and intensifies the pressure, forcing water into the rams at a pressure of 2,200 lbs. per sq. in. A flexible pipe connects the compressed-air main in the tunnel with the shield and the intensifier draws its water from two tanks also fixed in the shield, one on either side. The shield is fitted with an oak grouting-rib made in sections, having strips of leather nailed to its outer edge and projecting about ½-in. beyond the oak rib all around. This ring is held in position by the rams and serves to keep the grout in and to distribute the pressure of the rams evenly over the segments of the tunnel-lining.

The shield is moved forward in the following cycle: A box-heading is driven in advance of the shield, being always kept about 6 ft. or 8 ft. ahead of it. The heading is 6 ft. high and from 5 ft. to 6 ft. wide and is timbered with 4-in. x 4-in. head and side-trees. Two miners and two laborers



Work Done by Shield in One Stroke.

work continuously in the heading even while the shield is being moved forward and they are able to just keep pace with it. Just before the shield is moved forward, the last lining ring is grouted up, the grouting ribs being held in place by the rams. The clay ahead of the shield is roughly trimmed to the shape of the cutting edge for a distance of about 20 in. in front. Piles or cutting boards, 6 in. x 1¾ in. x 3 ft. long, sharpened to a point and shod with iron at one end are then placed in front of the shield and projecting out into the bank of clay as shown in the illustration. The number of these piles which are used varies with the nature of the ground; their purpose is to bring down the greater part of the clay as the shield moves forward. Small pockets are formed in the clay, just large enough to support the pointed ends of the piles until the shield starts. The first two rows of the heading lining are knocked away and laid across the entrance of the

*Extract from a paper presented to the Institution of Civil Engineers, London, by H. A. Bartlett, and reprinted from the Proceedings, Vol. 156.

heading to keep the clay from falling into it as it is brought down by the piles. Planks are laid from the heading to the platform of the shield to keep the loose clay from falling into the invert. The shield is given its full stroke of 20 in. without stopping unless going around a sharp curve in which case it is stopped at half-stroke to check its position. The work done in one stroke is shown in the illustration.

The shield having reached the end of its stroke, the rams are drawn back, the grouting rib is removed and the invert of the tail of the shield is cleaned out ready to receive the segments of the tunnel lining. While the shield is going forward the cast-iron segments for the ring, with the necessary bolts and packings, are brought forward on trolleys. The two bottom segments are placed in position on the skin and are bolted to the last ring erected, packings having been inserted in the joints. The packings are creosoted deal and are cut to the shape of the segment flanges with holes bored for the joint bolts. They vary in thickness from ⅜ in. upwards, thicker packings being necessary when going around curves. The next two segments or "side plates" are then lifted into position on the bottom plates and are similarly bolted to the last ring. Meanwhile, two miners, using the heap of clay in front of the shield as a platform have trimmed off the clay around the upper half of the cutting edge for a distance of 20 in. ahead of it, and have placed the cutting piles in position ready for the next advance. A temporary staging about 4 ft. above the rail-level is erected just back of the shield and the top segments and the key are lifted into position and temporarily propped, being forced about 1 in. higher than their final position in order to give sufficient clearance for fixing the key in place. When the key is in position, the temporary props are removed, the packings are inserted and the whole ring is bolted up. The remaining sections of the grouting-rib are then placed in position and the rams are forced out to hold them. The ring is then thoroughly grouted with lime or cement under a pressure of 60 lbs. per sq. in. As soon as the ring is bolted up, the temporary stage is removed, and the clay brought down by the piles is loaded into skips and run back to the shaft. When all the loose clay has been removed, the miners trim off the clay in the invert ahead of the shield, and the first two settings of the box-heading are knocked away preparatory to the next stroke of the shield.

Two sets of apparatus are used for guiding a shield, in order to control its movement, in respect to (1) line, and (2) level.

(1) Its movement in respect to line is controlled as follows: Two plumb-lines are suspended from the top of the tunnel, about 30 ft. apart, the forward line being about 12 ft. from the shield. These two lines are hung exactly on the center line of the tunnel if on a straight stretch, or on the tangent-line if the tunnel is on a curve. The shield is fitted with a removable center-rod, which can be fixed in two brackets on the back of the shield. On this center-rod a saw-cut is made, exactly in the center. In order to test the shield for position in line, the two plumb-lines are allowed to hang in the tunnel, and the center-rod is placed in position in the shield. If the saw-cut on the center-rod is in exact alinement with the two plumb-lines, the shield is in its correct position as to line; if it is found to be out of line, it must be brought right again by using more rams on one side than on the other. When going round a curve, a table of offsets for every foot of length is compiled. A mark is made on the center-rod, at a distance from the center saw-cut equal to the offset for the particular point as given in the table, and this mark is brought into alinement with the plumb-lines.

(2) For checking the position of the shield in respect of level, two adjustable boning-rods are bolted to the roof of the tunnel, about 30 ft. apart, the forward rod being about 10 ft. from the shield. The cross-pieces on these rods are adjusted to the required height by means of a level, and a fixed mark is made on the shield. If the shield is at its correct level this mark should be exactly in alinement with the tops of the two cross-pieces in the tunnel. If it is not, the level of the shield must be adjusted by putting more power on the top or bottom rams as required.

In a method of guiding the shield introduced by Mr. H. H. Dalrymple-Hay, two guide rods, each about 25 ft. long, are fixed to the shield on its horizontal diameter, one at each side. These guide-rods are graduated in feet and inches and are drawn forward by the shield past two "zero-pieces" or indexes fixed to the sides of the tunnel. As the shield advances in a straight line, the readings on both rods should of course be the same. If they differ, one side of the shield is gaining on the other and the shield is going "off line." For going around curves, a special shrunk scale is calculated for the inner side of the curve and marked on the inner guide rod so that the shield is guided on the curve by keeping the scale readings the same on both rods. With methods such as these it is fairly easy to keep the shield within 1 in. of its correct position.

Force Required to Drive a Shield in Tunneling Through London Clay.

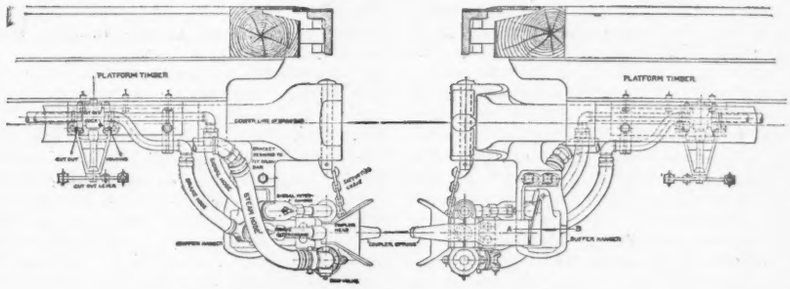
Shield—Diameter. Ft.	Shield—Diameter. Ins.	Shield—Circumference, Feet.	Rams—No.	Rams—Diameter. Inches.	Rams—Pressure, Lbs. per sq. in.	Pressure—Total Forward, Tons.	Pressure—Total Back. Tons.	Pressure—Resultant Forward. Tons.	Pressure per Foot-Run of Cutting-edge. Tons.	Remarks.
13	5¾	42.3	8	7	2,240	307.8	....	307.8	7.3	Maximum obtainable.
..	..	....	6	7	1,680	173.1	....	173.1	4.1	Piles used.
..	..	....	8	7	1,800	247.4	....	247.4	5.8	Piles used.
22	10	71.75	22	7	2,240	847.0	....	847.0	11.8	Maximum obtainable.
..	..	....	15	7	1,176	303.0	91.8	211.2	2.9	No piles used.
..	..	....	16	7	1,170	321.6	91.8	229.8	3.1	
..	..	....	18	7	1,150	356.4	91.8	264.6	3.7	
..	..	....	19	7	1,100	359.1	91.8	267.3	3.7	Piles used.
..	..	....	19	7	1,145	374.3	91.8	282.5	3.9	
..	..	....	20	7	1,000	344.0	91.8	252.2	3.5	
..	..	....	20	7	1,160	400.0	91.8	308.2	4.3	

NOTE.—Pressures are given in long tons of 2,240 lbs.

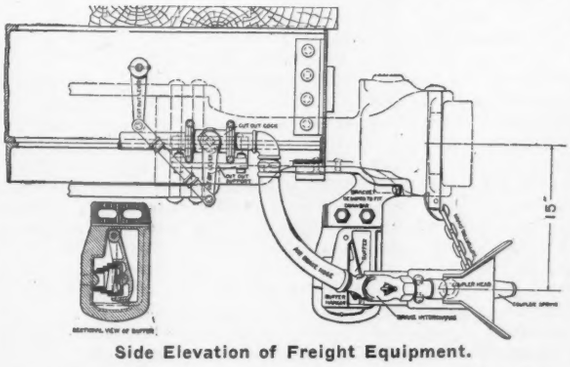
The force required to drive a shield depends, of course, on the nature of the soil through which the tunnel is being driven. The following table shows the force required to drive a shield through the London clay. The figures have been taken from actual observations and under varying conditions. The first three sets of observations apply to a shield 13 ft. 5¾ in. in diameter and the remainder to a shield 22 ft. 10 in. in diameter. In the case of the larger shield, the back pressure exerted by the six table-rams, each 7 in. in diameter, has to be deducted.

The Westinghouse Automatic Air and Steam Coupler.

The Westinghouse Automatic Air & Steam Coupler Company has an interesting exhibit in the Transportation Building at the World's Fair, St. Louis. It consists of an arrangement of two short car platforms modeled to represent the ends of passenger and freight cars, and also a locomotive pilot. One car platform is so mounted as to permit of a variation of four inches in its height, and it can be moved with considerable momentum toward either the locomotive pilot at one end or the other car platform at the other end. On these platforms and on the pilot are mounted full size models of the Westinghouse automatic air and steam coupler, and the device is shown under conditions closely approximating actual service conditions. The car platforms are so arranged that they may be coupled at an angle to each other, representing the case of an extreme curve and the movable platform is operated by compressed air, with an arrangement of an air cylinder and a slide valve connection. Both the 3-hose passenger equipment and the single-hose freight equipment are shown. Besides this exhibit there is a small model of two complete car trucks and frames fitted with air, steam and signal hose couplings which supplements the larger exhibit, and both are in more or less constant operation.



Side Elevation of Passenger Equipment.



Side Elevation of Freight Equipment.

The freight and passenger equipments are shown in the accompanying illustrations. The coupling head, which is of malleable iron having V and wedge-shaped guides projecting toward the front and an outwardly bent spring firmly riveted to the back, is supported by the coupling spring resting in the slotted buffer hanger, the hanger being bolted to a cast-steel bracket riveted to the drawbar. It is held in proper position by a chain attached to the draw-bar knuckle pin, and will adapt itself in coupling to differences in height of cars or angles of contact which do not permit the operation of the automatic car coupler itself. The slotted buffer hanger consists of a malleable iron frame embodying a spring seat and a cup-shaped buffing piece riveted from the upper part of the hanger. A volute spring holds the buffing piece forward to furnish a yielding resistance for the head during the coupling, and the car coupler itself checks the impact before the buffer spring of the automatic hose coupling has been fully compressed. The coupling heads, which are alike for passenger and freight service except in the number of gasket openings in the face, are so modeled that the positive engagement of the connections is effected without friction or wear on the gaskets, the gaskets being placed in holes in the coupling face connected to the pipe terminals by short hose.

The couplings are perfectly interchangeable and there are no rights or lefts. Proper provision has, of course, been made to allow connection with the automatic coupling and the old hand coupling. Coupling up the train lines between cars equipped with hand couplings and automatic couplings is effected in but little more time than that necessary for making the usual hand connections with the old method.

A convenient feature of the steam connection to the automatic head is that the parts may readily be removed in summer. The automatic drip valve which is a part of the steam attachment hangs down always at the lowest point in the steam connection, never failing to permit the condensation to escape at a pressure of four pounds or less, or at higher pressure when properly set, so that freezing, which is a common annoyance with hand hose couplings, is entirely avoided.

The device may be supplemented, if desired, by a cut-out mechanism for either passenger or freight service, which consists of a system of extension stems combined with proper link connections, by means of which the brake and signal cocks may be operated by a single handle from either side of the car. Provision is made by the various systems of steam heating for the operation of the steam valve without going between cars, usually by means of an extension rod secured to the step and connected to the valve by universal joints.

Besides this exhibit the automatic coupling is shown attached to an automatic dump car exhibited by the Goodwin Car Company. The Goodwin car requires three air connections; one for brakes and two for dumping. As these cars are usually used in railroad construction work, where they are operated over temporary tracks, the conditions are exceptionally severe, but the automatic coupling has given perfect satisfaction on all cars to which it has been applied. The special exhibition train of the Missouri Pacific, consisting of six cars and a locomotive, is also fitted throughout with the automatic passenger coupling equipment.

The automatic air and steam coupler has a number of apparent advantages. It does away with the danger to employees engaged in coupling hose between cars. Instances of scalding as a result of the unexpected uncoupling of the hand-steam connection are not infrequent, and a hot steam connection is also a dangerous thing to handle. The economy in time used in coupling and uncoupling cars is an important advantage, especially in the case of roads doing a large suburban business where a large number of trains must be handled in and out of the terminal within a short space of time. The New York Central has equipped all of its trains on the Putnam division with this automatic hose coupling and has found a great saving in time as a result. The Missouri Pacific has also adopted the automatic coupling for all the cars used in its suburban service out of St. Louis, and the Long Island has equipped its entire passenger rolling stock, consisting of 565 cars and 170 locomotives. This road has found that the congestion at its terminal station in Long Island City has been greatly relieved since the adoption of this device.

The material saving in the use of coupling hose is one which can be immediately reduced to a basis of dollars and cents. The New York Central has estimated that the cost of hose when using hand couplings is 230 per cent. of the cost of maintenance of the automatic couplings. It has been pointed out that by far the greater part of air hose removed from cars has been damaged by being cut, chafed, strained or torn at the nipple as a result of carelessness in uncoupling or pulling the hose apart before the connection has been uncoupled. The automatic coupling eliminates these losses entirely.

Inasmuch as the coupling forms an absolutely tight joint, the losses in the air brake and steam lines through the train are greatly reduced. Where the automatic coupling has been applied, a considerable saving in the amount of steam required to heat the train and the amount of air required to operate the brakes has been found. As yet the automatic coupling has been applied to passenger equipment only, but it has quite as many advantages for freight service as it has for passenger service. The congestion in yards where trains are made up and sorted would be relieved to a considerable extent if the time now consumed in coupling up and uncoupling air brakes was saved. It is almost impossible to enforce any rule calling for the coupling up of all brake connections throughout a long freight train, and as a rule only a few cars in the head of the train are coupled. As has been pointed out in these columns before, the dependence upon a few cars in the head end of a long train is probably the cause of a good proportion of the wheel failures due to excessive brake action and a good part of the damage done to draft gear and couplers. A device which would encourage the connection of all the cars in a train is to be commended for that reason if for no other.

Railroad Shop Tools.

(Continued.)

BORING MACHINES.

The horizontal boring machine shown in Figs. 1 and 2, is made by the Betts Machine Company, Wilmington, Del. This machine is known as No. 3. It is double back geared, which gives 15 changes of speed on the spindle. The spindle is cast steel 5 in. in diameter and has an adjustment of 30 in., with provision for 60 in. when required. The spindle can be driven in either direction and

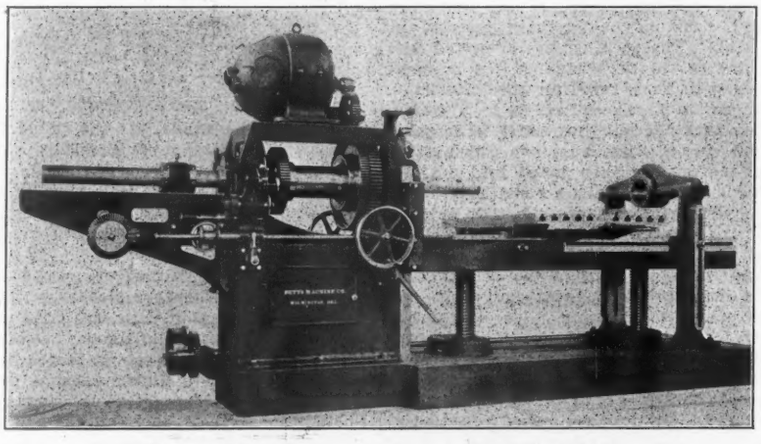


Fig. 1—The Betts No. 3 Horizontal Boring Machine.

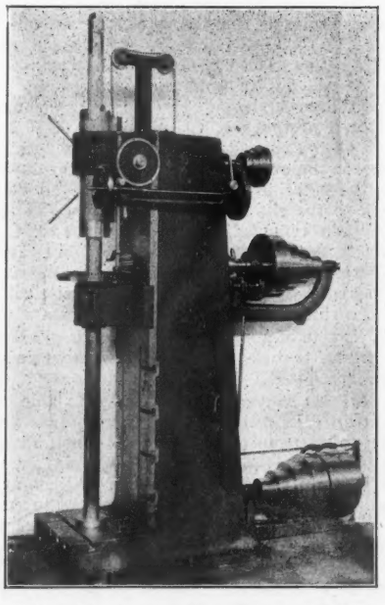


Fig. 3—Hoefer Vertical Boring Machine.

has a full bearing through the cast iron sleeve at all times. It has a quick hand movement by rack and pinion. It has an automatic variable feed from $^{1}/_{100}$ in. to $^{35}/_{100}$ in. and the spindle can be fed in either direction without reversing its motion. The table is 10 ft. long and is elevated by two screws, worm wheels and worms, which are driven by power. The table carries a saddle which has a movement parallel to the main spindle; on this saddle is a cross table 48 in. x 60 in. which has a horizontal movement at right

angles to the spindle. These tables can be lowered until the top table is 35 in. from the center of the spindle. By removing the upper tables, which are 6½ in. thick, the maximum distance from center of the spindle to the bed can be increased to 41½ in. The approximate weight of this machine is 30,000 lbs.

The vertical boring and drilling machine shown in the accompanying illustrations, Fig. 3, is made by the Hoefer Manufacturing Company, Freeport, Ill. It is especially designed for boring engine cylinders. One of the advantages of this type of machine is that the chips fall away from the cutters, thus preventing any chance of the chips wedging under the cutters and crowding up the boring bar. The spindle is of crucible steel 3⅜ in. in diameter and has an automatic feed of 16 in. in one setting and a vertical movement of 60 in. The spindle is supplied with both hand and power feed. The power feed can be stopped automatically at any desired point. The driving gears have a ratio of 4:1 and the machine is also supplied with back gears. The spindle is supported at its lower end by both a stationary and a revolving sleeve. The outer or revolving sleeve is supplied with a cap to prevent the borings from entering the bearings. The maximum distance from the face of the column to the center of the spindle is 8½ in. The machine occupies a floor space of 24 in. x 78 in. and the net weight of the machine is 5,500 lbs.

The accompanying illustration, Fig. 4, shows the new No. 1 "Precision" horizontal boring, drilling and milling machine made by the Lucas Machine Tool Company, Cleveland, Ohio. The principle of this machine is the raising and the lowering of the spindle and simultaneously with it, the outer support for the boring bar, instead of the conventional way of raising and lowering the table. This construction also makes possible the use of an exceedingly deep box bed, resting on three points, thus eliminating the necessity (and expense) of a foundation for the machine, and incidentally making it a matter of small expense to set the machine in a new location if desired.

The yoke carrying the outer support for the boring bar is fitted to the bed and is adjustable by a wrench to any point desired along the bed. Pieces of work longer than the nominal range of the machine may be drilled and milled. When holes are of such a length that the outer support for the boring bar is not needed they may be bored, by removing the upper portion of the yoke, which in this form of machine leaves the table as stiff, strong and efficient as before.

This machine will handle automobile engine work and the cross motion of the platen is such that cylinders and similar work may be bored and faced on the front and back portions of the platen alternately, thus making it easy to set one piece of work in position while the machine is at work on another. The platen has a milling feed. The vertical milling feed to the head, which is a regular feature of the larger machine, No. 2, may be easily and inexpensively applied to the machine shown.

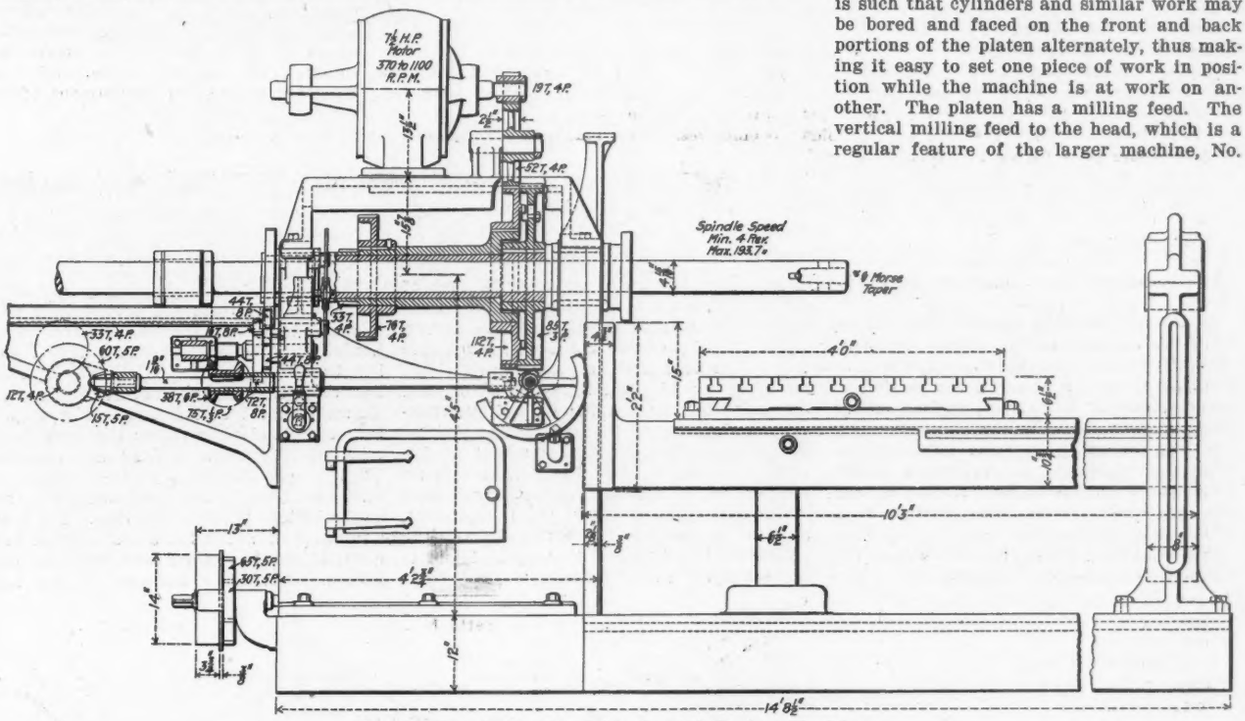


Fig. 2—The Betts No. 3 Horizontal Boring Machine.

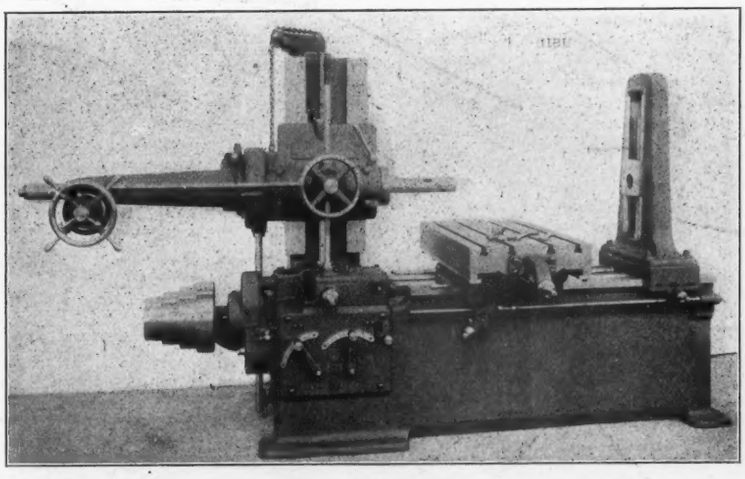


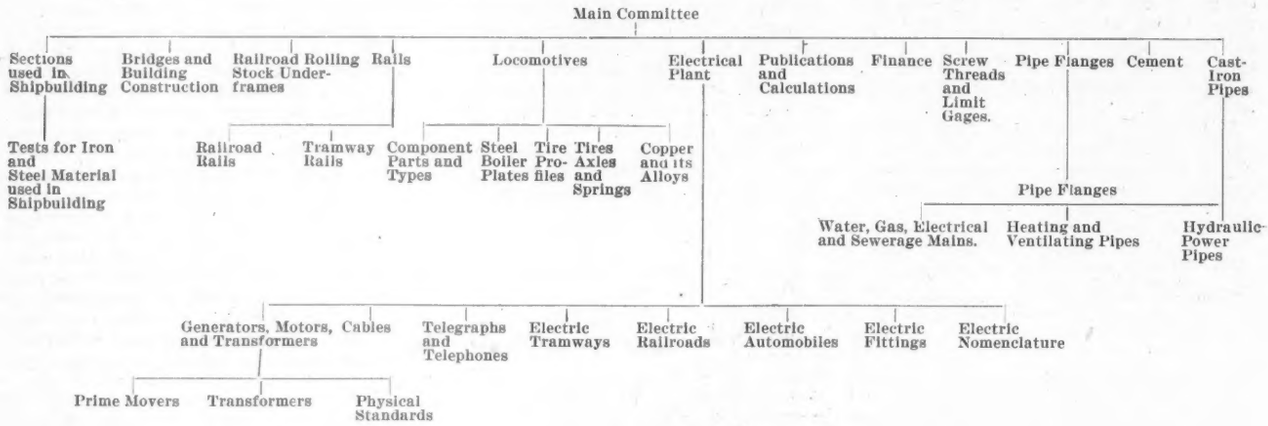
Fig. 4—The Lucas Horizontal Boring Machine.

The screws are all precision screws, cut from special hard steel and have adjustable dials graduated to thousandths of an inch, so that holes may be bored or surfaces milled an exact distance apart without jigs. The spindle is crucible steel and all working parts are ground or scraped. The machine is supplied with quick power moving devices, geared feeds, friction safety devices, etc., and it is adapted to receive single speed belt or electric drive when desired.

(To be continued.)

The New York *Tribune* of Aug. 18 announced in a leader that the first construction train had passed through the Simplon Tunnel and gave some account of that great undertaking. The *Tribune* is too previous. At the end of July there remained 1,393 ft. to be excavated to let daylight through. All work of extension at the north end has been suspended, on account of the difficulty of draining away the hot water springs, and with work going on at the south end only it was not expected to open through till October, and no construction train is likely to get through for months after that. The Milan Railroad exhibition, to celebrate the opening of the road, has been postponed till 1906. What has misled the *Tribune*, perhaps, is the passing of a construction train July 14 through a cork-screw tunnel, itself the trifle of about two miles long, on the railroad which is to connect the Italian system of railroads with the Simplon Tunnel; unless it may be the opening of the Austrian Wachein Tunnel May 31, less than four miles long.

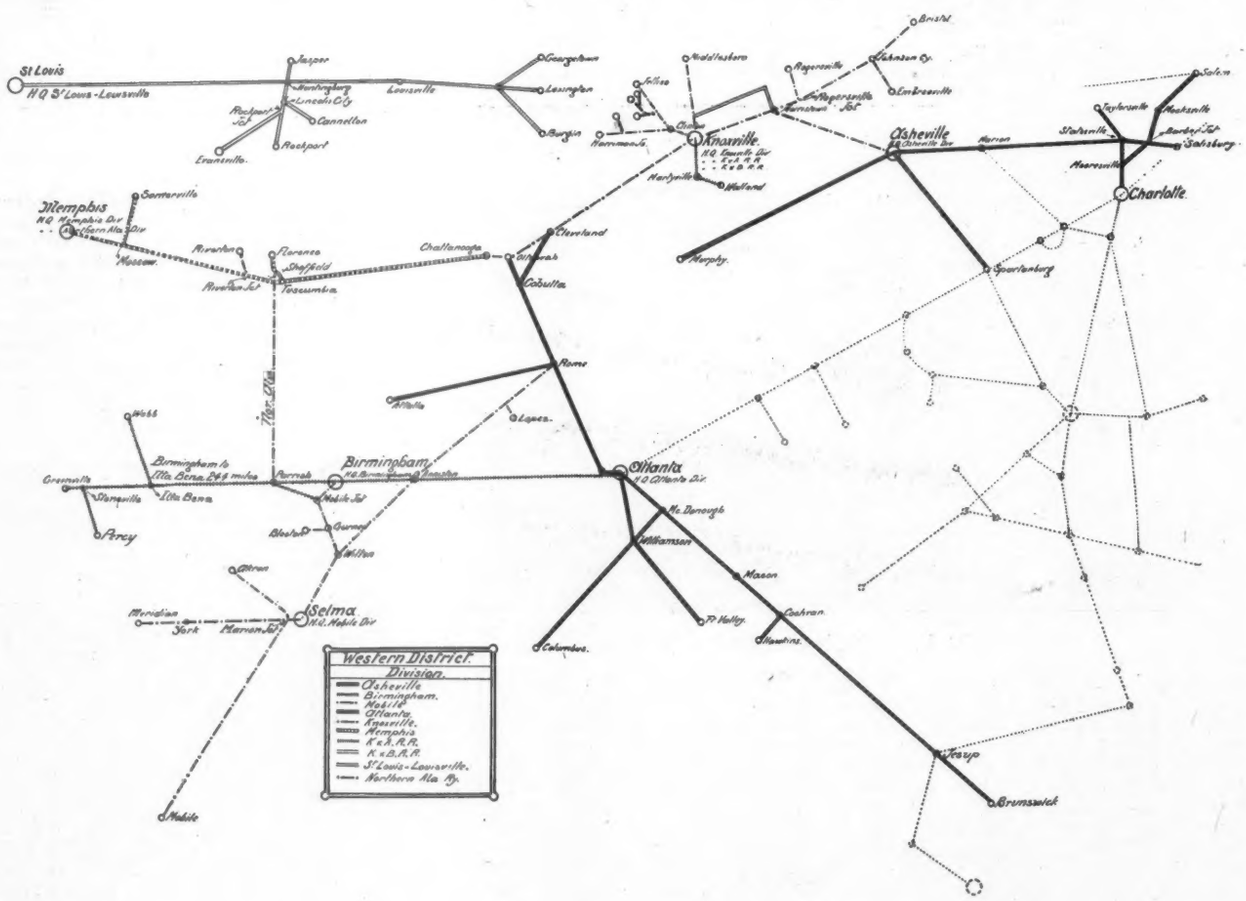
THE ENGINEERING STANDARDS COMMITTEE.



The Divisions of the Southern Railway.

In looking over the list of officers of the Southern Railway in the *Official Guide* recently, it was noticed that there had been an increase of over a third in the number of superintendents and assistant superintendents in one year, while there had been only a trifling increase in mileage. As more thorough supervision of the operating department is one of the improvements in railroad service which, we believe, ought to be widely copied, this looked like a significant fact; and to illustrate the situation on the Southern Railway we have procured a map showing the territories managed by each of the 15 division superintendents of the company. The map is shown herewith in two parts, the whole being too large for a single page. The lines of the company are divided, for purposes of administration, into what are called the Eastern district and the Western district, though they are not so strictly separated, geographically, as might be implied by these words. The Southern is an aggregation of a large number of railroads which until quite recently were independent, and the geographical simplification of the respective territories of the superintendents necessarily is a slow process.

The map on the left-hand page represents the western district, the easternmost point in which is Salem (and also contains the St. Louis-Louisville lines). Those lines belonging to the Eastern district, which extend into the territory embraced in this map, are shown in light dotted lines. The map on the right-hand page shows the eastern district, which extends as far west as Atlanta. On this map the lines of the western district are shown in the same manner as those of the eastern on the other map. The towns and cities at which there are division headquarters are shown on both maps in large letters. The other features of the maps



Western District of the Southern Railway.

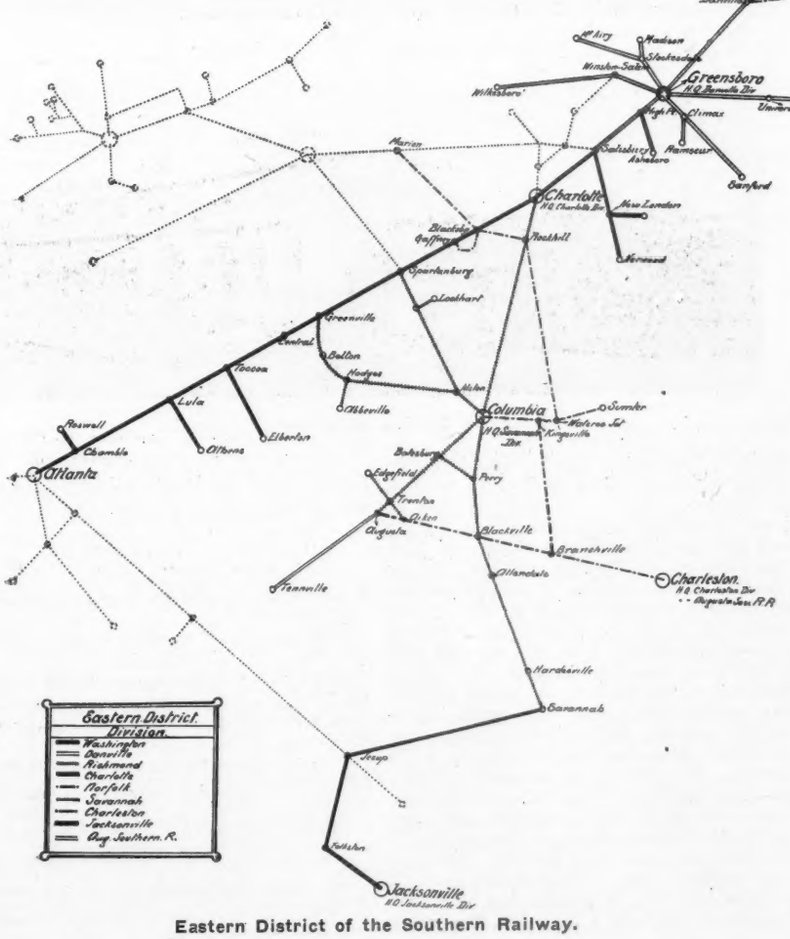
are self-explanatory. The reader will bear in mind that the St. Louis-Louisville lines, shown in the upper part of the left-hand map, are far removed geographically from the western district proper, the connection being by the Cincinnati, New Orleans & Texas Pacific, in which the Southern controls an interest. The St. Louis-Louisville lines, and the line from Birmingham to Greenville, are shortened to bring the map within the space available. With these two exceptions the maps are approximately correct as regards distances between principal towns.

Each division has a superintendent, and each superintendent is assisted by one or more subordinate officers, as follows:

Division and Officers.	Miles.
Washington (2 assistant superintendents)	344
Danville (1 assistant superintendent and 2 trainmasters)	639
Charlotte (2 trainmasters)	455
Richmond	283
Norfolk (1 trainmaster)	437
Savannah (1 trainmaster)	643
Charleston (1 trainmaster)	439
Jacksonville	145
Asheville (2 trainmasters)	449
Birmingham (1 assistant superintendent and 2 trainmasters)	576
Mobile (2 trainmasters)	572
Atlanta (2 trainmasters)	710
Knoxville (3 trainmasters)	552
Memphis (1 trainmaster)	332
Knoxville & Augusta and Knoxville & Bristol Railroads	66
Total Eastern District	3,385
Total Western District	3,257
Total miles	6,642
St. Louis-Louisville	505
Total Southern Railway	7,147
Independent roads: Northern Alabama 110	
Augusta Southern 83	
	193
Grand total	7,340

The General Manager of the Southern is at Washington, D. C.; the General Superintendent at Greensboro, N. C.; the Assistant General Superintendent in charge of the Eastern District, also at Greensboro, and the Assistant General Superintendent in charge of the Western district is at Birmingham.

The St. Louis-Louisville lines have a separate general manager, whose office is at St. Louis. The Northern Alabama is under the management of the superintendent of the Memphis division, and the Augusta Southern under that of the superintendent of the Charleston division.



Eastern District of the Southern Railway.

The Great Western Motor-Coach Services.

BY W. B. PALEY.

The Great Western has already added six services of steam to the two described in the *Railroad Gazette* of June 10. Two of these are partly over the same ground as the Westbourne Park and Southall service. One of them is between Park Royal and Acton, via West Ealing, and brings the great population about Ealing into direct communication with the beautiful Brent valley traversed by the new Greenford line. Ten trips are made in one direction and nine in the other, on week-days; eight and seven respectively on Sundays, on which day the service is not put on till the afternoon. The coach only remains at Acton two minutes before starting back, but stays at Park Royal on the average 21 minutes. The trips fit in between those of the other service so as to equalize the intervals between trains (that is, motors) so far as possible. Keeping the main line clear is the chief reason for the short stay at Acton, and the same applies to the Westbourne Park stop on the original service, also but two minutes.

On Sundays only, beginning August 7, motor-coaches have been run at intervals of about 35 minutes between Kensington (Addison Road Station) on the West London Railway, and West Ealing, over the above line. Not many people join at Addison Road but the next station, Uxbridge Road, adjoins the Shepherd's Bush terminus of the Central London or "Two-penny Tube," and taps the enormous traffic brought by that line. The new service is intended as a counter attraction to the London United Tramways, which end at the same place and do a prodigious business on fine Sundays. About a mile further north the motors turn off the West London (which the Great Western and London & North Western companies own jointly) at North Pole junction and cross the main fast roads at West London Junction on to the slow line, from which in a short distance the Greenford section diverges.

Low fares being absolutely necessary, sixpence only is charged to any of the stations or "haltes" on the new line, including return. The tickets are available at any of these places on either journey, which, though it seems a small thing, is quite a new departure. The furthest point, Castle Bar Park halte, to which the ticket takes you, is fully seven miles from Addison Road. So far the venture appears to have been successful, considering the short time it has been in operation, but the mode of working the traffic is somewhat peculiar and not apparently very economical. Two trains are used, each consisting of two motor-coaches with a six-wheeled saloon, third-class, placed between them. Smoking is allowed in the saloon, a term which here means a coach without compartments, entered by one door on each side and having the seats ranged round the sides and ends. Usually there are two tables in the middle. Both motors put on steam at starting, but the rear one shuts off after a time. Both take in water on the up journey, the leading one at Park Royal and the other at Addison Road before going back. On the Brentford branch the motor service was soon increased to every half-hour each way on Sunday afternoons and evenings, instead of once an hour. An intermediate "halte" has been opened, called Trumper's Crossing, the fare to it from either end being one penny. All the motor-coaches running in the London district are

kept at Southall, where they look rather odd, standing outside the running shed amongst goods and tank engines. Three are in use on week-days, each service employing only one, but on Sundays there are seven owing to the peculiar arrangement just described.

A motor service has also been started in the Plymouth district between Plympton, five miles east of the town, and Saltash, as much to the west. The distance between the two places direct is 9½ miles, but the cars run into Plymouth (Millbay) terminus, which lies at the end of a short branch, and out again, so that the whole trip is about 11 miles. Three additional stations, of a temporary character, have been constructed for the purpose of this service. The cars cross the Tamar over the celebrated Albert Bridge, built by Brunel in 1859, which immediately adjoins Saltash station. Slight variations exist in the service, some journeys ending short of Plympton, but the general effect is an addition of about a dozen extra communications per week day in each direction between the outlying extremities of the district and between these and the center of it. Eight such trips are given on Sundays, the whole being in addition to the ordinary train services. A motor coach also makes three trips each way between Plymouth and Yealmpton, half an hour's run with eight stops, part of it being over the Plympton route. Of the great advantage to the neighborhood of these new services no one who knows it can have a doubt.

Seventy miles further down, in Cornwall, a partial service of motor-coaches has been put on the branch, nearly nine miles long, that extends from Gwincar Road to Helston. It makes only four trips each way out of the total of eleven, most of them in the evening; but fills up its time with running three trips along the main line between Redruth and Hayle, 9½ miles, one between Hayle and Carnborne, six miles, and back to Gwincar Road. The total mileage it thus puts in is about 135½. On Sundays it merely performs the small service on the Helston branch, two trips each way, making 35 miles in all.

Two motor-coaches are now stationed at Wrexham, in Denbighshire, North Wales. One starts out at 9.55 a.m. and runs up the main line (Birkenhead section) to Gobowen, 12¼ miles. It soon comes back as far as Ruabon, 7½ miles, and sets forth on a trip of 45 miles of hilly and tortuous single line, amongst very grand mountain scenery, to Dolgelley, in Merionethshire. Staying there half an hour, it returns direct to Wrexham, finishing a day's work of 114½ miles at 4 p.m. The second coach leaves at 1.50 p.m. and goes via Ruabon along the Dolgelley line, but only so far as Bala, 27¼ miles out of the 45. At 2.53, at Corwen, it passes the other coach. Another double trip is made between Ruabon and Bala, after the last of which it makes two double trips of six miles between Ruabon and Llangollen, on the same line. Finally it gets home to Wrexham at 10.20 p.m., having done 142½ miles. One of the Bala journeys occupies only 67 minutes, with 10 stops. The Lambourn Valley Railway, only 12½ miles long, extending from near Newbury, on the Berks and Hants section of the Great Western to the small town of Lambourn, on the Wittshire downs, is now worked by a motor-coach. Hitherto it has provided its own rolling stock, of a light and somewhat peculiar kind. The line is single, laid with rails of the American type of only about 60 lbs. per yard, and has in places gradients as steep as 1 in 60. There are seven intermediate stations, several of them mere platforms quite as primitive as the "haltes" just constructed on the London & Greenford line. The motor makes five trips each way, equal to a day's work of 125 miles, 42 minutes being the usual time taken.

The figures given will afford a good idea of the working capacity of these vehicles. They are being tried under very different conditions of traffic, and on journeys varying from the nine minutes of the Brentford branch to the two hours of the Ruabon and Dolgelley run. The writer doubts if passengers who have booked through, first or second class, to stations served by motor-coaches which are third class only, will quite like the new system, and thinks the smoking question will probably cause friction sometimes. On the other hand, the spaciousness and airiness of the motors, the immensely improved view from the windows, and the saving of trouble in not having to pick out a compartment from amongst first, second and third-class smoking and non-smoking ones, will please a great many travelers.

Santa Fe Station in Oakland.

The Santa Fe has recently completed a new station at its Pacific Coast terminus at Oakland, California. The building is in the typical California style of Spanish mission architecture, which the Santa Fe has already introduced in the Stockton, Fresno and Berkeley passenger stations. In fact, this style of architecture has been closely followed in the building of all the stations on the San Joaquin Valley division of the Santa Fe. Both the Fresno and Oakland stations are built of steel lath covered with concrete and with red tile roofs. The one at Oakland is 204 ft. long, including arcades and baggage room, and 54 ft. wide, including the arcades. It is a two-story structure, 30 ft. high from the ground to the top of the towers. The station is extremely artistic and has arcades 12 ft. wide running entirely around it, and extending out from the ladies' waiting-room a distance of 75 ft. The cost was about $12,000. The first floor contains two waiting-rooms, each 24 ft. 9 in. by 27 ft., and connected by a hallway 22 ft. long and 7 ft. wide. The ticket office is 22 ft. by 15 ft. with the window opening into the hall between the two waiting-rooms. The interior finish of the waiting-room is in green wainscoting, with electric light fixtures. The office wainscoting and furniture is of oak, and the benches and seats are cut in the old Spanish style. Maple wood floors are used throughout. The second floor is devoted to the drafting room and private office of the assistant engineer. The station is located at 40th street and San Pueblo avenue, and extensive grounds have been laid out with flower beds, lawns and palm trees.

We are indebted to H. K. Gregory, assistant general passenger agent of the Santa Fe, for the photographs shown.

Santa Fe Station at Oakland, California.

Santa Fe Station at Fresno, California.

An Explanation of Form F.*

BY H. W. FORMAN.

Instead of regarding Form F as unimportant and merely a matter of point of view, the general and consistent theory upon which the Standard Code is constructed must be kept in mind while delving to get at its true meaning and application. It is hardly deserving of the opprobrium that is heaped upon it. The reason why it is more

*FORM F. FOR SECTIONS.

.....will display signals.....to.....for.....

EXAMPLES.

Eng 20 *will display signals and run as* 1*st No* 1 *London to Paris.*

No 1 *will display signals London to Dover for Eng* 85.

2*d No* 1 *will display signals London to Dover for Eng* 90.

This form may be modified as follows:

Engs 70 85 *and* 90 *will run as* 1*st* 2*d and* 3*d No.* 1.

Engs 70 85 *and* 90 *will run as* 1*st* 2*d and* 3*d No* 1 *London to Dover.*

Under these examples the engine last named will not display signals.

For annulling a section:

Eng 85 *is annulled as* 2*d No* 1 *from Chatham.*

If there are other sections following add:

Following sections will change numbers accordingly.

The character of a train for which signals are displayed may be stated. Each section affected by the order must have copies, and must arrange signals accordingly.

generally misunderstood than any other form is largely due to carelessness of examiners who jump at conclusions, instead of taking pains to learn just what the Train Rule Committee of the American Railway Association meant; and because of an unwillingness to concede that the rules have provided two ways for annulling trains—by their train numbers (Form K), and by their engine numbers (Form F). It appears to be difficult for many railroad men to accustom themselves to the simple proposition that a section of a train can be annulled by its engine number as effectually as a regular train can be discontinued by its train number, and that the same principle declared in Form K. to the effect that when a regular train is annulled it must not be restored, also applies to Form F. That is, when a section of a train is annulled by its engine number it must not be restored within that territory on that date. A perusal of Form F will convince anyone that the committee intended it to be used whenever sections were to be changed or annulled and that the movement must be made by the employment of engine numbers. Form K has an entirely different mission; it was never intended that an order should be given reading, "2d No. 1 of Feb. 29th is annulled Alaska to Halifax."

To fully understand Form F it is only necessary to keep these Code principles in mind and give due thought to what actually constitutes the annulment of a section and what simply authorizes the changing of sections or engines on sections. It is all-important that the address and wording of signal orders be in strict accordance with the rules.

The word "annulled" seems to be the stumbling block in this form, it being contended that it does not always mean what it says; that it purports to in some cases annul a section without doing so, while in others it does annul sections by mention of their engine numbers instead of only their train numbers. Granting that there may be ground for such criticism, I cannot see that those who have substituted the word "discontinued" for "annulled" have bettered the situation any, as there is no practical difference in the meaning of the two words. If everyone who has practically the same idea were allowed to give it a new dress and inject it into the Code, all the years devoted to securing uniform rules and getting them generally introduced would be wasted. It is to the interest of every railroader to uphold the present rules, making, if need be, personal sacrifice of opinion to maintain uniformity throughout the United States. It is, however, to be regretted that the committee framing Form F did not go into the matter a little deeper and give a few more examples which would enable anyone to fully understand the form without having to sometimes seek an explanation.

Suppose a district extends from A to Z, and that No. 1 runs from A to Z. When the despatcher issues an order for 1st and 2d No. 1 at C reading, "Eng. 85 is annulled as 2d No. 1 from C," 2d No. 1 of that date is annulled from C to Z and another 2d No. 1 must not be run anywhere between C and Z. He must not give a later order worded, "Eng. 85 (or any other) will run as 2d No. 1 C to Z," even if 1st No. 1 has not been given a copy of the first order and has not taken down signals, for the reason that this last order is an attempt to restore a section which has been properly annulled; any interested train may, upon receipt of the first order, proceed against 2d No. 1 anywhere between C and Z, because it has received the annulment of that section. Despatchers have been known to issue an order similar to the first example quoted (I have committed the same error), and afterward instruct No. 1 to display signals, say from G to Z, for a second section. It will be seen that this should not have been done. If it is desired to annul 2d No. 1 from C, and at the same time allow for a future 2d No. 1 from some station beyond C, the order annulling 2d No. 1 from C should indicate limits, thus, "Eng. 85 is annulled as 2d No. 1 C to G," then the despatcher may at any time thereafter authorize No. 1 to display signals for a second section between G and Z. Cases are on record where two orders were given to get the signals displayed by 1st No. 1 taken down and to annul the second section, thus, "1st No. 1 will take down signals at C," and "2d No. 1 of Feb. 29th is annulled C to Z," because trainmen and enginemen had never been instructed that an order reading, "Eng. 85 is annulled as 2d No. 1 from C" was not only authority for 1st No. 1 to take down its signals, but also was the annulment of 2d No. 1. The annulment of 2d No. 1 renders the signals displayed by the first section void and they must come down at C, or as soon thereafter as the order is received. If No. 2 was at G, holding an order to meet 1st and 2d No. 1 at that station, and, after 1st No. 1 had passed, it were to receive an order reading, "Eng. 85 is annulled as 2d No. 1 from C" it could proceed, as this order renders the meeting order void. A train that does not exist cannot be met.

So much for the annulment of a section. Now when is a section *not* annulled; that is, when is one simply displaced or dropped out, without in any way affecting the schedule or the signals that are displayed by sections in advance? An order addressed to 1st, 2d and 3d No. 1 reading, "Eng. 90 is annulled as 2d No. 1 from C following section will change number accordingly" does not annul 2d No. 1; it drops out the second section upon its arrival at C, but the same order further provides that a following section shall move up and take its place, therefore, under an order of this kind, 1st No. 1 must not take down its signals even if through error the order be addressed only to the first section, or it be found necessary to give it to 1st No. 1 after passing C. Another train receiving a copy of this order would not be justified in disregarding 2d No. 1, because it is clearly shown that a following section will assume that number. Nor is 2d No. 1 annulled when an order is issued reading, "Eng. 90 is annulled as 2d No. 1 from C. Eng. 70 will run as 2d No. 1 C to Z"; but if the order were to read "Eng. 90 is annulled as 2d No. 1 from C," *and stopped there*, without instructing following section or sections to change number or numbers accordingly, or without stating that some other engine would run as 2d No. 1 from C, then 2d No. 1 is annulled from C to the terminus of its run on that district. Thus it will be seen that when an engine is instructed to vacate a section, provision must always be made in the *same order* for keeping the section or train alive, or it is annulled. An order for 1st and 2d No. 1, worded, "Eng. 85 is annulled as 1st No. 1 from C following section will change number accordingly" accomplishes two ends: it takes down the signals on 1st No. 1 without annulling the schedule, but does annul the second section. Hence, the advantage in making use of the word "annulled" in this form, qualifying it when necessary, and the need of fully comprehending the theory upon which Form F is based.

Considerable condemnatory expression developed several years ago when the Train Rule Committee rendered a decision that it was necessary to advise the first section when the third was annulled. They did not say that it must always be done, only when the order creating the sections was worded as shown by the fourth Code example. It is not necessary that it be done in all cases, but often it is, to pave the way for a future order when the first section will be directly affected. To illustrate: if engines 70, 85 and 90 were instructed to run as 1st, 2d and 3d No. 1 A to Z and the despatcher desired to annul 3d from C and 2d from G, the order annulling 3d from C must also be addressed to 1st No. 1 at C or G, because if 1st No. 1 only receives the annulment of 2d No. 1 at G it would be doing wrong if it were to take down its signals, since notice was given to it in the order at A that the train would be run in three sections. The first section has the right, in such cases, to know that all following sections are annulled before removing its signals.

If there are five sections of a train and the despatcher desires to annul the 1st and 5th from C, only one order is required to make the movement if worded as follows: "Engs. 20 and 95 are annulled as 1st and 5th No. 1 from C following sections will change numbers accordingly." Under this order the first and fifth sections drop out and the remaining sections run as 1st, 2d and 3d No. 1 from C. The fourth section would, upon arrival at C, take down its signals and run as 3d No. 1 from that point.

When one section is run around another, some despatchers are under the impression that it is necessary to add to the order that the engine following will pass the one in advance, thus, "Engs. 70 and 85 are annulled as 1st and 2d No. 1 from C. Engs. 85 and 70 will run as 1st and 2d No. 1 C to Z. Eng. 85 will pass Eng. 70 at C," while others sometimes issue two orders, modeled (a) "Engs. 70 and 85 are annulled as 1st and 2d No. 1 from C." (b) "Engs. 85 and 70 will run as 1st and 2d No. 1 C to Z." Order *a* annuls both sections while *b* is an attempt to revive a schedule which has been ordered out of existence. If an order has been issued reading, "Engs. 70 and 85 are annulled as 1st and 2d No. 1 from C. Engs. 85 and 70 will run as 1st and 2d No. 1 C to Z,'" the second section would have been directed to pass, display signals and run as 1st, and the first section arriving at C would have allowed the following section to go by it and left there as 2d No. 1 without signals.

Sometimes the engine hauling No. 1 breaks down at C and is returned to A for repairs and perhaps another engine is sent to take No. 1 forward. In such event, orders have been issued annulling the original engine as No. 1, and when the relief engine arrived at C another order was given recreating No. 1. After studying the theory upon which the Code is made it will be seen that the first order, at least in effect, annulled No. 1 and that the later order restored a train which had been abolished. A message instructing the engines to be changed is all that is necessary, unless, in some rare contingency, it is deemed advisable to issue a train order to provide for some other movement, then the same order should also instruct some other engine to run as No. 1, otherwise, the schedule has seemingly been annulled. If the despatcher can find no other way out of a difficulty he should remember that he is always allowed to take away from sections all of their authority to proceed by annulling the order creating them without in any way affecting the schedule or so hampering himself that he cannot afterward legally create as many sections as he desires.

Form F, as here interpreted, may appear complicated, but it is hoped that the reverse may be found to be true and it is firmly be-

lieved that it will be if the examiner will prepare a series of train orders in chart form to exhibit to his class. When this practice has been followed it has been found that the men grasp the theory very quickly, and once they understand the form there should be no further misunderstanding or risk of accident.*

At the seventh annual convention of the Train Despatchers' Association of America, it was decided to petition the American Railway Association to change Form K to read "For Annulling a Schedule," and in other ways so modify the Revised Code that there would be a clear and sharp distinction between "train" and "schedule." The despatchers argue that often when the rules mean schedule the word train is erroneously used; that an engine displaying markers and running as an extra is a train, but has no schedule, and that time-table schedules, not trains, should be annulled. In some respects this alteration would improve the rules, but I cannot see that, even if this were done, a section could be annulled in one order and revived in another, even though the subheading of Form F be changed to read "for changing sections." There is a cardinal tenet that must always govern, namely, that when a regular train, or a section, is annulled (call it discontinued if the word annulled grates harshly upon the senses) it shall remain so, and it must not be restored by another later order. This reasoning is in harmony with Rule 82, which says that when a regular train loses right and class, by becoming 12 hours late, it ceases to exist for that date and no one must try to resurrect it by train order.

It would be unsafe to so refine the language of the Code that the average conductor or engineman could not readily and correctly interpret it.

Kitchen Cars on the New York Central.

The New York Central has recently built at its West Albany shops, a kitchen car or cafe coach for use in trains on which the travel is not heavy enough to justify hauling a dining car. The floor plan of this new car is shown in the accompanying drawing. It is 61 ft. long over end sills and is divided into three compartments, a seat compartment in one end for passengers, a dining compartment 18 ft. 1 in. long in the middle and a kitchen and pantry 17 ft. 8 in. long at the other end. The seat compartment is finished inside as a standard passenger coach with high-back seats upholstered in green plush, and will accommodate 24 persons. Lavatories for men and women and a wash stand and linen locker occupy part of the space in the end of the car. In the dining compartment 18 persons can be seated at the tables, which are arranged as in the ordinary dining car. The kitchen has every facility for serving the most elaborate meals. The interior finish of the whole car is light mahogany and no attempt has been made to have any elaborate ornamentation.

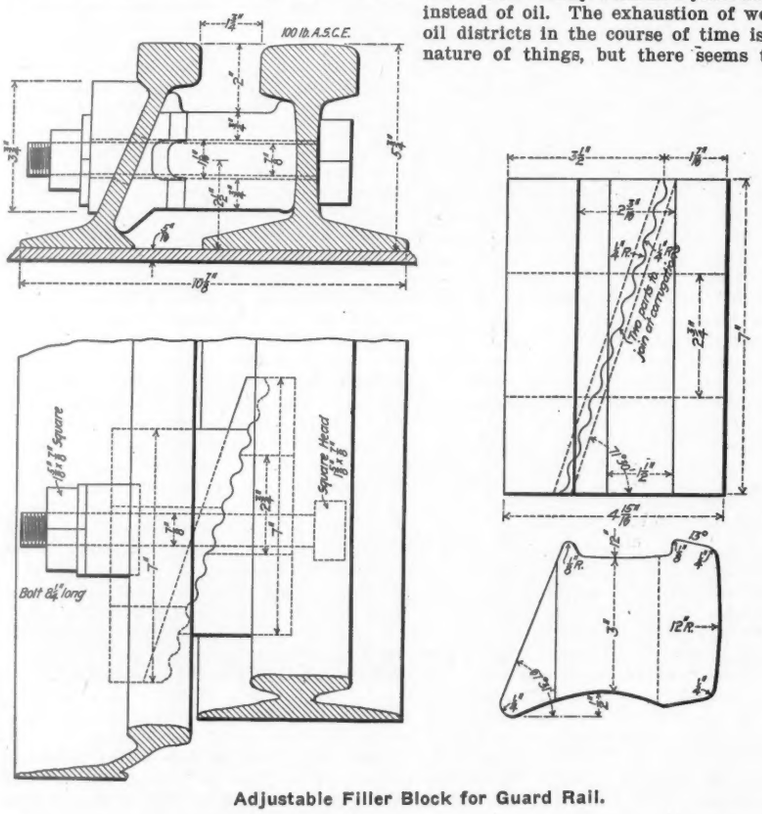
The Monon has a number of quite similar cars in use and the service which they give is said to be quite satisfactory. Much better meals can be served than from a buffet parlor or sleeping car and more persons can be accommodated at one time. Such a car also has an earning power as a passenger coach which a dining car has not. The service is *a la carte*, and extra waiters can be employed when necessary to serve meals to passengers in other cars in the train who may not wish to leave their seats.

We are indebted to Mr. F. W. Brazier, Assistant Superintendent of Rolling Stock, for the drawing.

*Further explanation of Form F by charts and questions and answers, will be found in "Rights of Trains on Single Track," a book by Mr. Forman, published by *The Railroad Gazette*.

An Adjustable Filler Block for Guard Rails.

The accompanying illustrations show an adjustable filler block designed by M. C. Hamilton, Eng. Main. of Way, Rapid Transit Subway Construction Company. This device consists of three parts, two wedge shaped pieces and one beveled washer. The wedges are pierced with an oblong hole, and have corrugated faces, as shown. These faces fit into each other, and pressure applied to them by means of the bolt which passes through the rails prevents them from slipping. With this device the guard rail can be adjusted any distance to from 1¾ in. up to 2½ in. The normal distance is 2 in.

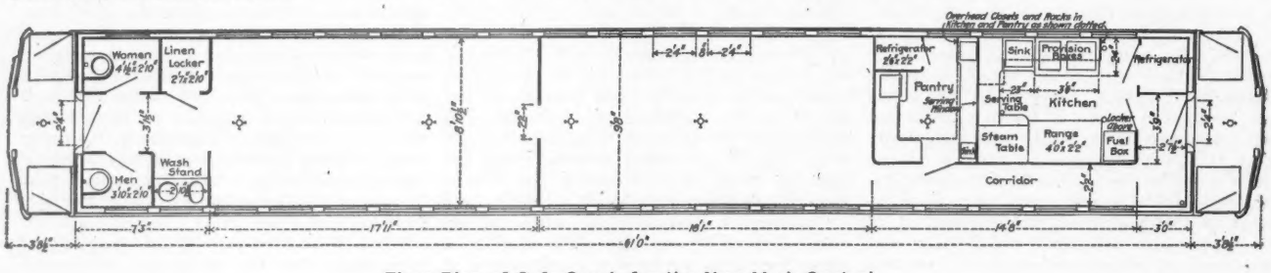


Adjustable Filler Block for Guard Rail.

Foreign Railroad Notes.

To a committee of the Bavarian Legislature the Minister of Transportation declared that on the State Railroads the question of temperance was a very serious one; and that he was determined to oppose beer drinking among enginemen and trainmen. This in the country where nearly everyone drinks beer, and very many large quantities of it, is especially significant. The means adopted to oppose beer drinking are chiefly the provision of hot tea and coffee and soup in winter, and aerated waters and other cool drinks in summer, at a fraction of the cost of beer.

Russian journals express alarm lest the petroleum production on the Caspian shore should fail, or decrease seriously, based on the fact that many wells now yield salt water instead of oil. The exhaustion of wells and oil districts in the course of time is in the nature of things, but there seems to have been no recent great change in Russia. It would be a serious matter to have a great decline there, because it has become almost indispensable as fuel. Nearly two-fifths of the locomotives in all Russia use petroleum, and nearly all steamboats on the Caspian and the Volga.



Floor Plan of Cafe Coach for the New York Central.

GENERAL NEWS SECTION

THE SCRAP HEAP.

The Lake Shore & Michigan Southern has put in its tracks a number of Buhrer cement steel sleepers.

It is announced from New Haven that the New York, New Haven & Hartford will hereafter employ no new men over 35 years old.

The Philadelphia & Reading is to equip with automatic block signals the Trenton branch, 3.7 miles long, extending from Trenton, N. J., to the New York division.

The Bessemer & Lake Erie reports that its trains have carried from Lake Erie ports to Pittsburg in one month 646,063 tons of ore, the heaviest month's business on record.

The New York City papers report that but few of the motormen on the elevated railroad have applied for positions on the subway trains, and the time for receiving such applications has now expired.

The production of anthracite coal for August amounted to 4,331,854 tons, as compared with 5,169,402 tons in August, 1903. The production for the year to September 1 has been 38,212,288 tons, as compared with 42,431,849 tons in the same period last year.

It is announced in Indianapolis that the two Holland sleeping cars, built recently to run on electric railroads, are to be at once put in service on the Appleyard lines, between Columbus and Cleveland. There will be one car each way each night, running by way of Newark, Zanesville and Akron.

The Northern Pacific is planning to put telephones in 48 stations on the Idaho, Rocky Mountain, Yellowstone and Dakota divisions. The instruments are the American Telephone & Telegraph Company's "composite sets," and they are to be worked on ordinary Morse telgraph wires, grounded in the usual way.

A considerable improvement in the volume of freight traffic is reported on the Pennsylvania Railroad, and Philadelphia and Pittsburg papers say that large numbers of the men lately laid off have been taken back. The shops at Altoona will be run on full time, 55 hours a week. At Altoona 7,000 men will be restored to the payrolls, and at West Philadelphia about 1,500; and at other shops in proportion.

The trans-continental express train of the Canadian Pacific was stopped by robbers near Mission Junction, B. C., on the night of September 10, and the valuables in the express car and the registered matter in the mail car were taken. The accounts say that the value of the booty was about $6,000.

On the night of September 12, passenger train No. 11 of the Chicago, Rock Island & Pacific was stopped by five robbers near Letts, Iowa, and the express car was robbed of about $20,000. The robbers blew open the safe, meantime firing bullets along the sides of the train to prevent interference by passengers. After finishing their job the robbers ordered the engine detached and went away on it. When near Columbus Junction they abandoned the engine and got away.

A southbound passenger train of the Wabash road was derailed near Pendleton, Mo., on September 6, and seven or more passengers were killed. A large number were injured. The day car appears to have been the first to leave the track; it fell down a bank, and the dining car, following, lodged on top of the day car, crushing the car and its occupants. It is said that repairmen at work on the track had left a rail insecurely fastened.

New Naval Vessels.

Plans for the battleship New Hampshire, and armored cruisers North Carolina and Montana, authorized by Congress last winter, have been completed by the Board of Construction and as soon as approved by the Secretary of the Navy the plans and specifications will be issued. The two colliers authorized last winter will be built, one at the New York Navy Yard and the other at the Navy Yard, Mare Island, Cal. It is stated that arrangements have been completed by the Navy Department with the Fore River Shipbuilding Company, successor to the Fore River Ship & Engine Building Co., for the completion of the battleships Rhode Island, New Jersey and Vermont.

Visit of the British Engineers.

About 90 of the 130 members of the Institution of Civil Engineers of Great Britain, visiting this country to attend the International Congress of Engineers at St. Louis, arrived in New York on Saturday last, and were informally entertained by members of the American Society of Civil Engineers. The party will stop in New York for about a week, and will then go to St. Louis by special train through Canada. Among the gentlemen in this party are: Sir William White; Alexander Ross, Chief Engineer of the Great Northern Railway; Professor W. C. Unwin; Dr. Tudsbury; L. L. Robertson; P. W. Meik; W. H. Hunter, Chief Engineer of the Manchester Ship Canal; H. H. Wake, Chief Engineer of the Sunderland Harbor Board, and J. A. F. Aspinall, General Manager of the Lancashire & Yorkshire.

The Exhibit of C. H. Bradley & Co. at St. Louis.

High speed, vertical, reciprocating engines of large size have reached their greatest development in England, due perhaps to the fact that engines used on steamships are of that type. The engine shown by C. H. Bradley, Jr., & Co., Pittsburg, was originally developed by Williams & Robinson, Rugby, England. It is a triple expansion engine, the steam ports and valves between the three tandem cylinders being located in the common piston rod. There are two sets of cylinders, the cranks on the common shaft being set at right angles. The engine on exhibition is used in the Exposition arc lighting service. It is built in accordance with the metric system throughout. The condensing apparatus consists of a 2,000 sq. ft. Worthington condenser, a Blake vertical twin beam air pump, and an 8-in. Worthington volute circulating pump.

"Needed the Money."

Not all of the summer excursions are in the North. One of the largest of which we have seen mention was that run from Charleston, S. C., to the Blue Ridge Mountains in North Carolina, on Aug. 17, by the Southern Railway. This train carried 459 passengers. One which was run over the Atlantic Coast Line the same day carried 260. An excursion at the other extreme of the map was one from Salt Lake City, Utah, to Alberta, Canada. This appears to have been run, however, not on account of the coolness at Alberta, but because a large number of people who formerly resided in Utah have settled in the region of Alberta. Possibly all of these excursions may have been run, in part, for the reason which led the Southern Pacific to run a special train of ten coaches from Houston, Tex., to New Orleans on Aug. 23. On this train there were 500 people. A reporter who visited the station to see the people off, inquired of an officer of the passenger department as to the object of the excursion; if there were any big event at New Orleans that occasioned it. "None at all," he replied; "we just needed the money; that is the reason we are running it."

Erie Improvements at Jersey City.

The Erie is rearranging and enlarging its engine house and yard facilities and next year expects to carry out extensive improvements in its terminals at Jersey City. The work which is being done at the present time includes the mounting of an additional 65-ft. turn-table with 20 radial tracks for storing engines and building a new engine house for caring for the new motive power which is being put into service. The turntable will be operated by a 6-h.p. Fairbanks-Morse gasolene engine. The new engine house will be a double rectangular structure, 241 ft. by 240 ft., with a 75-ft. transfer table between, and will accommodate 29 engines. It is not large enough to house more than a third of the engines in the yard at any one time, but it will materially assist in caring for and cleaning those required for immediate use. Later on, ample facilities for caring for all the motive power will be provided. To facilitate the movement of engines to and from trains, the engine yard will be rearranged and a number of new tracks put in so as to allow free movements in each direction. The large increase in the milk traffic of this company has also made necessary the construction of 1,200 ft. of new unloading platforms, all of which will be covered with umbrella sheds. Part of the

driveway for express wagons and milk carts will also be covered over.

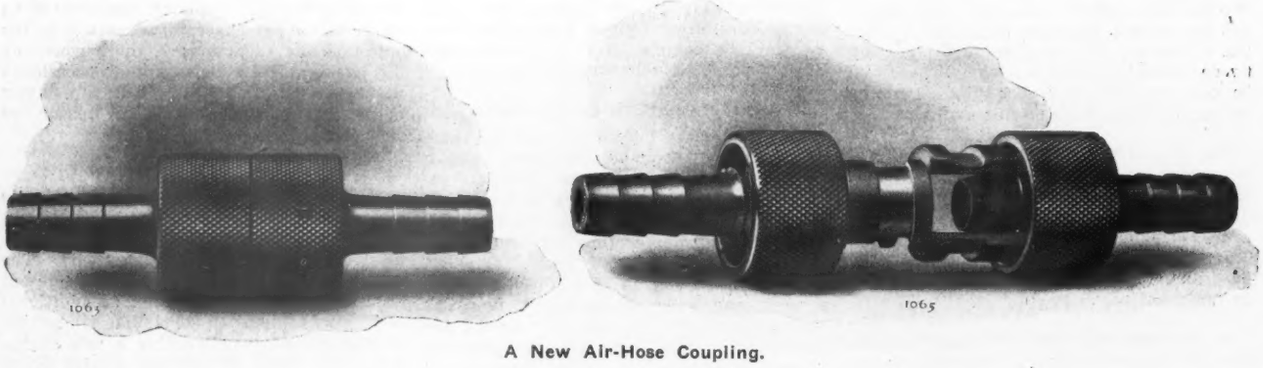
North Western Track Depression in Milwaukee.

The work of depressing 2.8 miles of its track in the city of Milwaukee, Wis., which the Chicago & North Western has been engaged upon since the early spring, is nearing completion. The work was undertaken for the purpose of eliminating a number of grade crossings of busy streets, and involves an expense of between eight and nine hundred thousand dollars. The maximum depression was 22 ft. and the total amount of material removed about 500,000 cu. yds. This section of the line, which was double tracked, formerly had .7 per cent. grades against both north and southbound traffic. The approach grades to the depressed section are now .31 per cent. descending, following which is a level stretch and then a .31 per cent. ascending grade.

There are nine overhead crossings, which are through plate girder spans with I-beam and concrete arch floors, overlaid with Milwaukee standard brick paving. Traffic at the busier crossings has been carried on temporary structures composed each of a timber Howe truss span and timber approaches. All bridge abutments, and such retaining walls as were needed, are of stone, as the railroad company has its own quarries near Green Bay, Wis., and can therefore put in this work cheaper than concrete. A third track was put in in connection with the other work, and this, together with the need of maintaining uninterruptedly a heavy traffic, added considerably to the difficulty of the task.

A New Air-Hose Coupling.

A new coupling known as "Giv't-a-Twist" is made by the pneumatic tool department of the Ingersoll-Sergeant Drill Company, New York. It is designed for use in connection with pneumatic tools. No wrench is required to either couple or uncouple the parts. To make a coupling it is only necessary to push the halves together by hand and slightly twist the locking rings in opposite directions. To uncouple the operation is reversed. Both halves of the coupling being identically the same, the necessity of mating the ends is obviated. The parts are made of brass, extra heavy, to stand rough usage and are machined throughout. This coupling is made in all standard sizes for connecting hose to hose; hose to pipe, or pipe to pipe with male or female shanks.



A New Air-Hose Coupling.

New Plans to Aid Bridge Traffic.

New plans for facilitating traffic at the Manhattan terminals of the Brooklyn, Manhattan and Williamsburg bridges were submitted to Mayor McClellan by George E. Best, Commissioner of Bridges. Mr. Best's latest plan includes both an elevated railway system across the lower end of the city from river to river and a subway to be used for trolley cars to run from the Cortlandt and Liberty street ferries to connect with the terminals of two of the new bridges.

One plan is to have an elevated structure through Canal street from Greenwich street on the Hudson River to the Manhattan Bridge terminal with a branch through Elm street, Center street or the Bowery to Delancey street and thence to the terminal of the Williamsburg Bridge. The other plan is for a trolley subway under Delancey street, the Bowery, across town under Spring street to Hudson, thence south under Hudson street, West Broadway and Greenwich street, as far as the Pennsylvania Railroad Jersey City ferry at Cortlandt street and to the Liberty street ferry of the Central Railroad of New Jersey. A branch under Duane street dropping below the level of the present subway at Elm street is proposed in connection with the projected station at Center street, there to join with the trolley lines from Brooklyn, which could use the basement of this station as a terminal and through station. This line, the Commissioner suggests, might be constructed by the Brooklyn trolley companies as a feeder to their lines across the river, or by the Jersey City railroad company's, whose cars will soon cross the Hudson River by tunnel, and who would no doubt be willing to avail themselves of an opportunity to obtain connection with two of the Brooklyn bridges.

A Floating Exposition for Asia.

It is announced in Seattle that an ocean steamship, the Victoria, is to sail from that port on November 15 with what may be called a traveling trade exhibit, for the purpose of promoting the sale of American goods in Asia, Australia, South Africa and South America. The ship will visit Yokohama, Kobe, Nagasaki (Port Arthur and Vladivostok, war conditions permitting), Shanghai, Hong Kong, Manila, Singapore, Colombo, Mauritius, Delagoa Bay, Cape Town, Adelaide, Melbourne, Sydney, Honolulu, and, on the return, Santiago, Valparaiso and Callao, South America. At each of these ports it will remain from two days to ten days, a total of about six months having been assigned for the voyage. American consuls in all of the cities will be informed in advance of the arrival of the floating exhibition, announcements will be made (in the newspapers of the ports) of the names of the firms represented on board the vessel, their lines of business, and the consuls will be requested to see that importing and exporting merchants in the interior and adjacent cities are fully advised. James J. Hill, President of the Great Northern Railway, is one of the chief promoters of the scheme, and he, in connection with the Northwestern Commercial Company, is now issuing invitations to American manufacturers and merchants to join in the enterprise. The exhibit will be managed in a manner similar to that pursued with exhibits of certain Western States which have been carried around this country in railroad cars. The vessel will be attractively decorated, and $100,000 is being spent in preparing it for the proposed use. For 100 to 500 cubic feet of space, and passage, meals, etc., for an agent, the exhibitor will be asked from $1,500 to $2,500. There will be no charge for light or power.

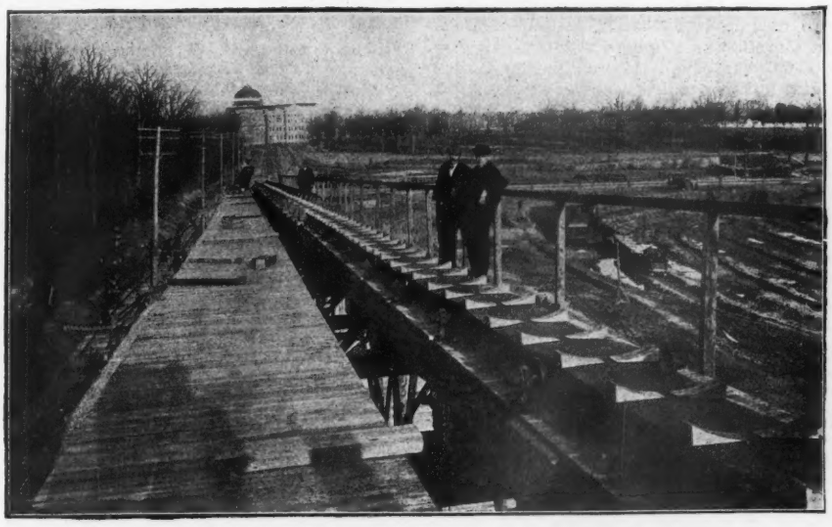
The Subway Motorman.

The lot of the subway motorman may be monotonous, but it cannot be denied that in proportion to the amount of skill he is required to possess, in addition to a normal endowment of health and senses, he will be very liberally paid. An average young man with the average endowment of intelligence could qualify for his duties in a fraction of the time required to learn one operation in any mechanical trade under the best conditions of instruction and opportunity. To the trade of the machinist, for example, his vocation is as grinding a handorgan to playing the piano. His power is supplied, and the highly refined mechanism of the controller places it absolutely at his command. He can take much or little, as suits his momentary purpose. He turns it on and off as he would open and close a faucet on a Croton water pipe. As compared with the work of the street car motorman, his task is easy. He has a clear and unobstructed track, with infrequent stops, and the only thing he must avoid is trying to pass another train which happens to be ahead of him. In the equipment of the subway every contingency has been so perfectly provided for that he cannot very well make a mistake, even if so reckless as to want to. He is quite sure that no wagon will cut across his path from the recesses of a side street, that fire engines and extension ladders on wheels will not smash into him, and that children will not play tag and tip-cat on his right of way. When the novelty of his position wears off he will have absolutely nothing in a day's experience to rack his nerves or send cold chills coursing up and down his spinal column.

Whether he is overpaid or not is a matter of judgment. In connection with wages for labor high and low are relative terms. It is obvious, however, that the wage of three dollars and a half for a ten-hour day in operating a subway motor should command the services of very good men, and that the Interborough management is justified in fixing and maintaining a high standard of fidelity and physical fitness, and of efficiency in train operation. Whether a relatively high wage will secure these we shall know when the results of a year's operation of the subway are available for study.—*New York Times.*

The Ridgway Two-Belt Conveyor System.

In the two-belt conveyor system one belt is used for carrying the load and the other for transmitting power. The power belt is flat and runs over straight faced pulleys and rollers. Attached to the power belt at frequent intervals are a number of troughing blocks. These separate the conveying belt from the power belt. The conveying belt is threaded over its own head and tail pulleys in the usual manner and has an independent takeup. The two belts move in the same direction and at the same speed, but the conveying belt can be lifted off the supporting belt out of the troughing blocks and passed through a stationary dumper or a movable tripper. It is claimed that with this design of conveyor the belts have a longer life, and that less power is required for operating. The top belt of the conveyor system carries only a sufficient tension to move one-third of the moving parts, the other two-thirds are carried by the interior belt. This belt being flat is relieved of all transverse or troughing strains. The troughing blocks are made of white wood dipped in oil to prevent checking and are copper riveted to the belt. The rollers over which the belt is carried are mounted on horizontal steel shafts which are run in babbitted ring oiled bearings. A conveyor of this type was used in connection with the concrete work during the construction of the Washington, D. C., filtration plant.



Two-Belt Conveyor—Showing Inner Belt with Troughing Blocks Attached.

The Making of High-Speed Tools.

Mr. Edward Ford in a paper on high-speed steel, read before the National Association of Blacksmiths held at Indianapolis, said in part, that in making the high-speed tools great care should be taken and that the tool dresser should in all cases heat the steel thoroughly and not too fast, to a high lemon heat while shaping the tool, and when done, lay it aside for a few minutes to cool and to relieve the stains; then heat up to a high heat, or until the scales can be seen rising, then place it under a compressed air blast, (be sure there is no moisture in the air pipes before placing the tool there to be hardened) then allow the blast to strike the tool at about one inch from the point. Always have the blast blowing toward the point of the tool and keep the point of the tool free from scales with a file, so that the cold air will play on the point of the tool. Where there is no compressed air, a good substitute can be found in the blast pipe.

Manufacturing and Business.

Cal. Hirsch & Sons Iron & Rail Company, St. Louis, have opened offices at rooms 306 and 308 Railway Exchange, Chicago.

Frank Davies has been appointed New Orleans agent for the Railroad Supply Co., Chicago, with headquarters in the Hencen Bldg.

Jose Eugenio Ribera, San Sebastian, Spain, engineer in charge, is making plans for building an iron bridge over the Urumea river at San Sebastian.

The American Machinery Co. is looking for a site at Grand Rapids, Mich., to build a $20,000 factory. Machinery will be put in at a total cost of about $200,000.

Bids are wanted by the Brazilian Secretary of Agriculture until October 22 for building a railroad from Ilheos, on the eastern coast in the State of Bahia, west to Conquista, 160 miles.

The Goldschmidt Thermit Company, New York, state that arrangements have been completed for making its heating and welding compound known as Thermit in this country.

A contract, it is reported, has been given by the Delaware, Lackawanna & Western for building a new pier 100 ft. x 1,200 ft. at Hoboken, N. J., to Henry Sters, of New York, at $300,000.

The United States Locomotive and Equipment Co., of Bridgeport, has been incorporated in Connecticut with a capital of $100,000 by A. T. Cole, C. H. Woerner and Wm. J. Bagnell, of Bayonne, N. J.

The Globe Pneumatic Tool Co., of Lyons, has been incorporated in New York to sell pneumatic tools, etc., with a capital of $100,000. The incorporators are: F. M. Van Wagonen, P. S. Hill and H. T. Mead, of New York.

Philip W. Moen, of Worcester, Mass., formerly General Manager of the Washburn & Moen Wire Works, and up to two years ago a Vice-President and Director of the American Steel & Wire Co., died September 12, aged 47 years.

The Engineering & Developing Co., of New York, has been incorporated to make machinery. The directors are: E. H. Cook, Boulder, Colo.; H. S. McCartney, Philadelphia, and Karl A. A. Stachlgreau.

The New York Continental Jewell Filtration Company, of New York and Chicago, report an active demand for their water purifying appliances. Among some of its recent installations is a filter at the Jerome avenue pumping station, New York city, to be used for boiler service.

The Pressed Steel Car Company announce that J. S. Turner, general sales agent of the Standard Coupler Company, will become a sales agent of the Pressed Steel Car Company on the 19th instant. Mr. Turner will be connected with the New York office and will travel in the territory assigned to the eastern district.

At the Westinghouse Electric & Manufacturing plant at East Pittsburg, a large number of men have resumed work. The works of the Westinghouse Machine Co. now employ the largest force in its history. At the plant at Wilmerding, a full force of 1,500 men are employed. The Westinghouse foundries at Trafford City will resume operation in full, giving employment to about 3,000 more men.

Walter A. Zelnicker Supply Company, St. Louis, has established two new branch offices, one at 1711 Tremont street, Denver, Colo., and the other at 45 Dey street, New York. This company now has branch offices in Mobile, New Orleans and Seattle, and sales offices in Houston, Tex.; Denver and New York. Its rail yard and warehouse are located in East St. Louis, and the factory for making the "double-clutch" car mover at New Madison, Ohio. The company reports present business good and prospects encouraging.

S. Pearson & Son, Incorporated, who are building the Pennsylvania Railroad tunnels under the East River and Long Island City, have just awarded the contract for two complete compressed air power plants, to the Ingersoll-Sergeant Drill Company of New York. The combined capacity of the plants consists of 50,000 cu. ft. of low pressure air per minute and 12,000 cu. ft. of high pressure air per minute. This is said to be the largest order ever placed in the history of the business. The plants will be erected by the Ingersoll-Sergeant Drill Company under the personal supervision of J. H. Jowett, sales manager of the company.

At the foreclosure sale at Quincy Sept. 7, of the property of the Fore River Ship & Engine Co., all the property was bought in by Henry Endicott, Jr., of Boston, for $1,000,000. The outstanding indebtedness of the company was $1,606,000. This sale also included the contracts already made with the governments and others. Three battle ships are now under construction for the United States at the yards of the company. The purchase was made under the direction of the reorganization committee, which has been incorporated under the laws of Massachusetts under the name of the Fore River Shipbuilding Co., of Quincy, with a capital stock of $4,800,000, divided into 24,000 shares of common and a similar number of shares of 6 per cent. non-cumulative preferred stock.

Iron and Steel.

The Baltimore & Ohio, it is said, will place contracts some time next month for about 50,000 tons of rails.

A contract, it is said, will soon be given by the municipal authorities of The Hague,

Holland, for about 8,000 tons of rails for building an electric traction system.

At a meeting of the Steel Plate Association held September 6, a reduction was made in the price of steel plates from $6 to $4 a ton. A corresponding cut in the price of structural material was also made.

The United States Steel Corporation, it is said, has moved 1,500,000 tons of ore in the Lake region during August and expects to exceed that amount this month. The total for the season will probably reach about 12,000,000 tons.

The American Shipbuilding Co. has given contracts for about 5,000 tons of steel plates, 3,000 tons of which were given to the United States Steel Corporation and 2,000 to the Cambria Steel Co., to be used for the new steel ships to be built on the lakes.

The Grand Trunk Pacific, it is reported, is in the market for 100,000 tons of rails for 1905 delivery, and it is expected that the contracts will be given to American companies, as Canadian rail makers will probably not be able to furnish this quantity.

The Carnegie Steel Co., it is said, has been awarded a contract by the Japanese Government for 7,500 tons of nickel steel plates for use on Japanese battleships. This order, it is expected, will keep the 84-in. and 184-in. mills of the Homestead plant busy for three months.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 30.)

Engineers' Club of Cincinnati.

At the regular monthly meeting of this club September 15, a paper was read on "Paints and Painting," by James A. Lilly.

Engineers' Club of Philadelphia.

At the meeting of this club to be held September 17, an election of new members will take place and a paper by Dr. Henry Leffmann on "George Washington as an Engineer" will be presented, with illustrations.

Western Railway Club.

The Western Railway Club will hold its first fall meeting in the Auditorium Hotel, Chicago, at 2 p.m. Tuesday, September 20. There will be two papers for discussion. (1) "The Relative Merits of Large Grates and Heating Surfaces, and Their Proportions." This paper is a part of the last Master Mechanics' Committee report on "Coal Consumption on Locomotives." (2) "Negative Work of Back Pressure and Compression in Locomotives," by Ira C. Hubbell. The club will consider the invitation to all of the railroad clubs to hold a joint meeting in the Transportation Building of the World's Fair the latter part of the month, and action will be taken on the matter.

PERSONAL.

—Mr. F. C. Rowland, at one time General Manager of the Norwalk Iron Works, died at his home in New Haven, Conn., on Sept. 8, at the age of 60.

—Mr. William B. Putney, a Director of the Genesee & Wyoming Railroad, and a lawyer of New York city, died at his summer home at Suffern, N. Y., on Sept. 10, at the age of 69.

—Mr. John Stewart, formerly and for a number of years Superintendent of the Canadian Pacific, died suddenly in Woodstock, N. B., on Sept. 5, at the age of 59. Mr. Stewart began railroad service in 1867 as a conductor on the New Brunswick & Canada, and was successively Superintendent, Traffic Superintendent and General Superintendent. When this company became a part of the Canadian Pacific, Mr. Stewart was appointed Superintendent, which position he held for a number of years.

—Mr. William Amburn Gavett, formerly and for a number of years in the passenger department of the Chicago & West Michigan, died on September 11, at Detroit, Mich. Mr. Gavett was a native of Michigan and was 60 years old. He was in the United States military railway service at Nashville, Tenn., in 1864. Later he was General Freight and Passenger Agent of the Texas & St. Louis, and for two years, from 1882, was the United States Treasury Agent in charge of the international traffic at Detroit and Port Huron over the Michigan Central and Grand Trunk Railroads. At the time of Mr. Gavett's death he was accounting agent for the Internal Revenue Department.

—Mr. George Henry Kimball, the new Chief Engineer of the Chicago & Alton, has for some time past been connected with the Central Electric Construction Company and the Buffalo Terminal as Chief Engineer. Mr. Kimball is 55 years old, and is a graduate of the Massachusetts Institute of Technology. His first railroad service was on the Pitts-

burg, Cincinnati & St. Louis as Superintendent of Bridges and Buildings. This was in 1876. Three years later he left this company and went to the Columbus & Sunday Creek Valley, which is now a part of the Toledo & Ohio Central, as Superintendent. Then for a short time he was Engineer of Maintenance of Way of the Little Miami (Pittsburg, Cincinnati, Chicago & St. Louis), but in 1881, resigned from this position to go to the Toledo, Cincinnati & St. Louis, as Chief Engineer of the Southeastern extension. Then for seven years, 1882-89, Mr. Kimball was a Superintendent on the New York, Chicago & St. Louis. In March, 1889, he entered the engineering department of the Lake Shore & Michigan Southern, and was Chief Engineer of this company until 1891, when he took up general practice as a Consulting Engineer. For a time he was on the Columbus, Sandusky & Hocking as Superintendent and Chief Engineer, and in 1900, became Chief Engineer of the Pere Marquette, which position he resigned to go to the Central Electric Construction Company. This latter position he now leaves to succeed Mr. Baldwin, who in the early part of this year resigned as Chief Engineer of the Alton.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—E. W. Day has been appointed Assistant Superintendent of Telegraph.

Cedar Falls & Northeastern.—The officers of this company (an Illinois Central enterprise) are: President, Stuyvesant Fish; First Vice-President, J. C. Welling; Second Vice-President, J. T. Harahan; Secretary, W. G. Bruen, and Treasurer, J. F. Titus. (See Railroad Construction column Sept. 9, p. 86.)

Central of New Jersey.—See Erie.

Chicago & Alton.—G. H. Kimball has been appointed Chief Engineer, with headquarters at Chicago, Ill. Mr. Kimball succeeds H. F. Baldwin.

Chicago, Burlington & Quincy.—T. E. Calvert, hitherto General Superintendent of the Lines West of the Missouri River at Lincoln, Neb., has been appointed Chief Engineer of all lines of this company, with headquarters at Chicago, Ill. The positions formerly held by Mr. Calvert and Mr. Rhodes, General Superintendent and Assistant General Superintendent of the Lines West, have been abolished. The Lines West of the Missouri River have been divided into two districts, to be known as the Nebraska District and the Wyoming District. H. E. Byram has been appointed General Superintendent of the Nebraska District, which comprises the Lincoln, Wymore and McCook Divisions, with headquarters at Lincoln, Neb. G. W. Rhodes has been appointed General Superintendent of the Wyoming District, which comprises the Alliance, Sheridan and Sterling Divisions, with headquarters at Alliance, Neb. The position of Chief Engineer of the Lines West of the Missouri River having been abolished, I. S. P. Weeks, hitherto Chief Engineer of the Lines West, has been appointed Engineer of the Lines West, with headquarters at Lincoln. W. L. Breckinridge has been appointed Engineer of the Lines East of the Missouri River, with headquarters at Chicago, and the position formerly held by him, Chief Engineer of the Lines East of the Missouri River, has been abolished. The Sterling Division has been created to consist of the line Holdrege to Cheyenne, with headquarters at Holyoke, Colo.

Chicago Great Western.—M. D. Flower has been elected a Director, succeeding W. A. Read.

Delaware, Lackawanna & Western.—The headquarters of Riley Williams, Superintendent of the Bangor and Portland Division, have been removed from Bangor, Pa., to Easton, Pa.

Denver & Rio Grande.—H. E. Herr, hitherto Master Mechanic of the Norfolk & Western, at Roanoke, Va., has been appointed Assistant to the Vice-President of the D. & R., with office at Denver, Colo.

Egyptian Coal Railroad of Illinois.—The officers of this company, are: President, R. E. Renfro; Vice-President, G. R. Huffman; Secretary and Treasurer, J. B. Bundy; General Manager and Attorney, Charles E. Hamilton, and Chief Engineer, F. Hutchinson.

Erie.—R. W. Burnett, hitherto General Foreman of Car Repair of the Central of New Jersey, has been appointed Assistant Master Car Builder of the Erie at Buffalo, N. Y.

Houston & Texas Central.—E. E. Shackford, hitherto Vice-President, Treasurer and General Manager of the San Antonio & Gulf, has been appointed Superintendent of the Second Division of the H. & T. C., with headquarters at Ennis, Texas, succeeding L. A. Daffan, who has been appointed General Agent of the transportation department.

Illinois Central.—H. W. Parkhurst, hitherto Engineer of Bridges and Buildings, has been made Consulting Engineer of Bridges and Buildings. F. H. Bainbridge, hitherto

Superintendent of Bridges, has been appointed Engineer of Bridges and Buildings, succeeding Mr. Parkhurst, and R. E. Gaut, hitherto Chief Draftsman, has been appointed Assistant Engineer of Bridges.

Lehigh Valley.—Rollin H. Wilbur, General Manager, having resigned, effective October 1, the office of General Manager will be abolished, and all communications heretofore addressed to the General Manager will after that date be addressed to the President's office, 143 Liberty street, New York city.

Mexican Central.—The headquarters of H. R. Nickerson, Vice-President, have been removed from the City of Mexico to New York city. O. K. Hamilton, hitherto Assistant to the Vice-President in Mexico, has been appointed Assistant to the President, in charge of traffic.

Mexican International.—Richard Marsh has been appointed Assistant Engineer.

Missouri Pacific.—E. F. Hogle has been appointed Superintendent, with headquarters at Nevada, Mo., succeeding J. M. Sommers, who has been transferred, as Superintendent, to Osawatomie, Kan.

St. Louis & San Francisco.—M. C. Byers has been appointed Assistant Engineer of Maintenance of Way, with headquarters at St. Louis, Mo.

San Antonio & Gulf.—See Houston & Texas Central.

Seaboard Air Line.—M. J. McDonough has been appointed Soliciting Freight Agent at Birmingham, Ala.

Texas Southern.—M. J. O'Learny has been appointed Master Mechanic.

LOCOMOTIVE BUILDING.

The Toledo, St. Louis & Western is reported in the market for from six to ten locomotives.

The Central of Georgia has ordered 20 simple consolidation locomotives from the Baldwin Locomotive Works for September and October delivery, as reported in our issue of August 19. These engines will weigh 156,940 lbs., with 140,740 lbs. on drivers, and will have cylinders 20 in. x 28 in., 50-in. driving wheels, wagon-top boiler with a working steam pressure of 200 lbs., 271 tubes of 2 in. external diameter and 14 ft. 8 in. long. The fire-box will measure 103 in. long x 41⅞ in. wide, and the tank will have a capacity of 5,000 gallons of water and 10 tons of coal. Special equipment includes: Westinghouse air-brakes, hammered steel axles, sectional Magnesia boiler lagging, Tower couplers, Pyle-National and Dressel headlights, Nathan Simplex injectors, Ajax bearings, U. S. piston and valve-rod packings, Leach sanding devices, Nathan sight-feed lubricators, Standard steel-tired driving and truck wheels and chilled cast-iron wheels under the tender.

CAR BUILDING.

The Erie is reported in the market for 1,000 coal cars.

The American Car & Foundry Co. has miscellaneous orders for 35 cars.

The Southern is reported to be in the market for 15 new passenger coaches.

The Toledo, St. Louis & Western is reported in the market for passenger cars.

The Louisville & Nashville is reported about to build 1,000 coal cars at its own shops.

The El Paso & Southwestern, as reported in our issue of Sept. 2, has ordered 30 steel ore cars of 100,000 lbs. capacity from the Pressed Steel Car Co., for Nov. 15 delivery.

The Seaboard Air Line is in the market for two 61-ft. combination mail and baggage cars. The special equipment will include: National-Hollow brake-beams, Westinghouse air-brakes and Janney-Buhoup couplers.

The Baltimore & Ohio, as reported in our issue of September 2, has ordered 1,000 drop-end gondola cars from the Standard Steel Car Co. These cars will have a capacity of 100,000 lbs. and will weigh 45,800 lbs. They will be 40 ft. long inside, 8 ft. 5 in. wide inside, and 2 ft. 6 in. high inside. The underframes will be of steel and the floor and sides will be of wood.

The Argentine Government, as reported in our issue of September 9, has ordered 640 freight cars from the Middletown Car Works. This order includes 250 box cars, 100 gondola cars, 150 flat cars, 90 stock cars and 25 tank cars. These will all have a capacity of 66,000 lbs. each, will have steel underframes and wooden bodies and will be built for one-meter gage. The order also includes 25 flat cars with wooden underframes and 20 tons capacity.

The Baltimore & Ohio has ordered 250 refrigerator cars from the South Baltimore Steel Car & Foundry Co., as reported in our issue of August 26. These cars will have a capacity of 70,000 lbs. and will be 40 ft. long over sills, 9 ft. 4½ in. wide over body, and 14 ft. high to top of brake shaft. The frames and underframes will be of wood. The special equipment includes: Westinghouse air-brakes, tandem draft rigging, B. & O. standard journal boxes, helical springs and lateral-motion trucks.

The Consolidated Railway Company of Connecticut, which is a part of the New York, New Haven & Hartford, has ordered 15 cars from the Jewett Car Co. and 15 cars from John Stevenson & Co. for November delivery. The cars will be 40 ft. 10 in. long over all, 8 ft. 4 in. wide and 11 ft. 6 in. high. Special equipment includes: Taylor trucks, Westinghouse air-brakes, Metropolitan type couplers, Keeler curtain fixtures, Pantasote curtains, Gold heating system, Pullman roofs and Heywood Bros. & Wakefield Co.'s seats.

The Georgia Southern & Florida has ordered two sleeping cars from the Barney & Smith Car Co., as reported in our issue of August 26. The order calls for delivery in November. These cars will be 72 ft. long and 9 ft. 8 in. wide, and the estimated weight is 120,000 lbs. The underframes will be of Southern pine with wrought iron sill plates. The special equipment includes: Diamond-Special brake-beams, Lappin brake-shoes, Westinghouse air-brakes, Buhoup three-stem couplers, Forsythe curtain fixtures, silk-faced Pantasote curtains, Symington dust guards, Safety car heating system, Standard steel platforms, tin roofs, Railway Steel-Spring Co.'s springs, Symington journal boxes, six-wheel trucks, Pullman wide vestibules and Standard steel-tired wheels with retaining rings.

BRIDGE BUILDING.

AKRON, OHIO.—The County Commissioners, in connection with the Northern Ohio Traction & Light Co., it is said, will jointly build a combined highway and street railroad bridge over the tracks of the Baltimore & Ohio to cost about $30,000.

ALLENTOWN, PA.—A new girder bridge will be built over the Lehigh river by the Central Railroad of New Jersey to replace the present structure.

BOISE, IDAHO.—Bids are wanted September 20 by W. L. Cuddy for repairs to the bridge over Boise river near Star, in Ada County.

BOSTON, MASS.—City Engineer Jackson has plans made and approved by the Cambridge Bridge Commission for a bridge to be built at Brookline street between Cambridge and Brighton, to cost about $120,000.

CHICAGO, ILL.—It is reported that the council will allow about $1,100,000 for repairs to present bridges and for new structures, which will include those at Halstead street, Archer avenue and North avenue, and a new bridge at the foot of Michigan avenue boulevard over the Chicago river, to cost about $125,000.

CLEVELAND, OHIO.—The Wheeling & Lake Erie, it is said, is planning to build a bridge over the Cuyahoga river at the foot of Cross street to replace the present structure. It is to be a swing bridge with one short span and one long one. Work will be started early next spring.

Bids are wanted September 21 by Cuyahoga County Commissioners for some steel bridges and stone and concrete work. W. H. Evers is County Surveyor.

COLUMBIA, LA.—The Police Jury of Caldwell has given a contract to the Virginia Bridge & Iron Co., of Roanoke, Va., at $32,000 for building a highway bridge over the Ouachita river at Columbia.

CONCONULLY, WASH.—Bids are wanted October 4 by Okanogan County Commissioners for building a bridge over the Okanogan river at Riverside. F. M. Willmarth is County Auditor.

DES MOINES, IOWA.—The Interurban Railway Co., it is reported, will build a steel bridge over the Des Moines river, to cost about $50,000.

DORCHESTER, ONT.—Bids are wanted by W. V. Lane, Township Clerk, for building a bridge at Center road over the Thames river. Plans at County Commissioner's office, London, Ont.

FINDLAY, OHIO.—Bonds for $50,000 for building and repairing bridges, it is reported, have been voted by Hancock County.

GREEN BAY, WIS.—Bids are wanted September 29 for building a steel drawbridge over East river on Webster avenue. W. L. Kerr is City Clerk.

GROSSE POINTE, MICH.—Residents have voted to issue $17,000 of bonds for repairing bridges over Fox and Connors creeks.

INDIANAPOLIS, IND.—The County Commissioners have given a contract for a new bridge over White river at Michigan street, which is to be a concrete steel structure 340 ft. long of three spans, and a 40-ft. roadway with 10-ft. sidewalks, to carry electric cars.

JACKSONVILLE, FLA.—An ordinance has passed the Council to issue bonds for $300,000, which includes $25,000 for building a bridge over the Hillsboro river.

MARSHALLTOWN, IOWA.—Residents are petitioning the Railroad Commissioners to change the site for the proposed railroad viaduct from Center street to South Third avenue.

MILLERS FALLS, MASS.—The application of the Northfield & Millers Falls Street Railway Co. for permission to use the bridges entering this place has been refused and the company will have to build its own bridge to enter the town.

MILWAUKEE, WIS.—Bids may soon be asked for a steel or concrete viaduct to be built over the Menominee valley at the end of Grand avenue.

MISSOURI VALLEY, IOWA.—It is reported that work will soon be started to build three new piers in the Missouri river close to the Chicago, St. Paul, Minneapolis & Omaha Blair bridge. It is believed that the present bridge is to be enlarged and double tracked.

NEBRASKA CITY, NEB.—Bids are wanted September 20 by Otoe County Commissioners for some bridge work. C. H. Busch is County Clerk.

NEW ORLEANS, LA.—Bids are wanted No-

vember 4 by V. Tujague, Controller, for building a viaduct to carry Newton street in Algiers over the tracks of the Southern Pacific. The plans, filed with W. J. Hardee, City Engineer, call for a structure with approaches 2,306 ft. long from the east side of Bellville street to the west side of Whitney street, with 28-ft. roadway and six foot sidewalks to carry a single track for an electric road.

Orilla, Ont.—Bids are being asked by R. H. Jupp for building a steel bridge over the Severn river.

Pembroke, Ont.—McNab Township will build a steel bridge over the Madawaska river, at Clay Bank, to cost about $12,000.

Philadelphia, Pa.—Plans have been completed by the Bureau of Surveys for a new bridge on the line of Allegheny avenue to carry eight tracks of the New York branch of the Pennsylvania over the main thoroughfare. An appropriation of $80,000 is available out of the $16,000,000 loaned for this work; but, as it will cost an amount greatly in excess of this, Director of Public Works, Peter E. Costello, is negotiating with the officials of the railroad company to pay a share of the cost.

Bids have been asked for the new bridges on the lines of Thirty-third street and also on Erie avenue.

Reading, Pa.—The Philadelphia & Reading bridge near Port Clinton, it is reported, will be replaced by a steel structure, for which plans are being made.

St. Paul, Minn.—A resolution has been passed by the assembly authorizing the asking of bids for a new bridge at Payne avenue and Beaumont street.

Scranton, Pa.—The Delaware, Lackawanna & Western is having plans made for building a large concrete arch with a number of smaller arches over the Lackawanna river near Bridge street to replace the present structure.

Shamokin, Pa.—The Board of County Commissioners, it is reported, has decided to build a new bridge at Market street.

Sunbury, Pa.—Soundings are being made in the river to locate the site for a combined highway and street railroad bridge here.

Troy, Mo.—Bids are wanted September 28 by T. A. Halby, Road and Bridge Commissioner, for building a steel bridge 180 ft. long over the Cuivre river. N. R. Long is County Clerk.

Other Structures.

Alexandria, Va.—The Pennsylvania, it is reported, has plans ready for a large freight storage yard with a capacity for 10,000 cars per day for the joint use of that company, the Baltimore & Ohio, Seaboard Air Line, Atlantic Coast Line, Southern, and the Richmond, Fredericksburg & Potomac.

Buffalo, N. Y.—The Delaware, Lackawanna & Western has given a contract to F. D. Hyde, of New York, for building its freight house 60 ft. x 475 ft., two stories high, to cost $51,000, at Columbia and Penz streets, on which work will be commenced at once.

Chicago, Ill.—The Lake Shore & Michigan Southern, it is reported, has decided to rebuild its old warehouses and also to build a new one, connecting them with the tunnel which is being built by the Illinois Tunnel Co., to connect all the freight houses and yards in the city and within 30 miles of the city. The new warehouse is to be at Clark and Taylor streets, and the old ones to be rebuilt at Polk street and Pacific avenue. The new walls will be sunk to the lower level of the tunnel and side tracks and freight yards will be built under ground.

The Chicago Terminal Transfer Co. has given a contract to Henry W. Schluter for its brick, stone and concrete steel freight house 30 ft. x 800 ft., to cost $50,000, which will be built at Polk and Fifth avenues.

The Michigan Central, it is reported, will build an office building at the foot of South Water street. It will be four stories high and 35 ft. x 100 ft., to cost about $25,000.

Cincinnati, Ohio.—The Cincinnati Southern has been granted a permit to build the proposed new terminal station at Front, Commerce and Race streets.

El Paso, Tex.—The bids recently opened for building the union passenger station ranged from $132,000 to $139,000. The contract, it is said, has been given to M. M. Rocke, of Houston, the lowest bidder.

New Orleans, La.—The Illinois Central, it is reported, will build a warehouse if permission is granted by the city to close three streets.

Olean, N. Y.—The Pennsylvania shops recently put up at this place, it is reported, will be enlarged and a large power house about 100 ft. square is also to be put up, for which a contract will be let in a few days.

San Luis Potosi, Mex.—The National Railroad, it is reported, will build another addition to its shops here.

Sidney, N. S.—The Intercolonial has located a site for its new passenger station, on which work will be commenced this fall.

Springfield, Ohio.—The C., C., C. & St. L., Pennsylvania, Detroit Southern and perhaps the Erie will jointly build a union passenger station here.

Swanson, Mich.—The Wisconsin & Michigan, it is reported, will build a large station here.

Walawala, Wash.—The Washington & Columbia River Railroad, it is reported, will remove its shops from Hunt's Junction to this place. New buildings will be put up and the machinery from the former place removed at once, which will be used for a roundhouse.

Waycross, Ga.—The Atlantic & Birmingham, it is said, have commenced work on large shops here.

Yankton, S. Dak.—The City Council has granted certain franchises to the Milwaukee and it is now in a position to build its new station here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Arkansas, Missouri & Kansas.—Work on this road, it is reported, is progressing rapidly between Scammon and Mineral, Kan., and it is expected that rails will be laid next month. It is the intention of the company to build the section of the road between Chanute and Joplin as early as possible, and finally to extend it to Memphis, Tenn. Surveys are now being made between Joplin and Butterfield, Mo., in Barry County.

Baltimore & Ohio.—A cut-off from Hancock, Md., to Port Perry, Pa., 180 miles, which will be a saving of about 60 miles over the present route, is projected. The new line will pass between the lines of the Pennsylvania and the Baltimore & Ohio, and will connect with the Johnstown branch. It will permit the shipment of coal from the Connellsville district direct to tidewater.

Birmingham, Columbus & St. Andrews Bay.—Work will be commenced by Contractor L. E. Miller, of Philadelphia, on an extension of this road at Chipley, Fla., on the section to St. Andrews Bay, Fla., 60 miles. The road will later be extended to Birmingham, Ala., via Columbus, making a total of 360 miles. The company has filed for record in Alabama counties through which it will pass, a mortgage for $9,360,000, with the West End Trust Co., of Philadelphia, as trustee, securing a bond issue.

Butte County.—Work has been commenced by the Stone Co. on grading the extension of this road between Stirling City, Cal., and a point on the north fork of Feather river, in Plumas County.

Cananea & Topolobampo.—Surveys are being made for the proposed line, which is to be built from Cananea, State of Sonora, Mexico, to Topolobampo, Sinaloa, 430 miles, and giving an all-Mexican route from this section to the City of Mexico. Surveys are reported made from Cananea to Minaca. W. C. Green, President of the Cananea Copper Co., will build the road.

Chattanooga & Montlake.—Application has been made by this company for a charter in Tennessee to build a road from the mines of the Montlake Coal Co., in Chickamauga gulch, near Daisy, to Chattanooga, 20 miles. G. W. Nixon, President of the Montlake Coal Co., is one of the principal promoters of the road.

Chesapeake & Ohio.—The extension from Whitehouse to Paintsville, in Johnson County, Ky., 15 miles, was completed September 1. This line opens up a rich territory in lumber and coal and will later be extended further into the mountains.

Chicago, Burlington & Quincy.—The new cut-off of this road between Mexico, Mo., and Old Monroe, 63 miles, has been completed and will be used jointly by the C., B. & Q. and the Chicago & Alton.

Clarksdale, Lyon & Friars Point.—It is proposed to build under this name, from Clarksdale to Friars Point, Tenn., 14 miles. J. F. Hunter, Manager of the Tennessee Trust Co., Memphis, Tenn., is interested.

Coahuila & Pacific.—This road, which now exists from Saltillo to Torreon, 191 miles, it is reported, will build an extension to reach Tampico, 380 miles. Negotiations are now in progress for the sale of the road and the trustees are asking the consent of the creditors to authorize the sale.

Coeur d'Alene & Spokane.—This company, which operates a road between Coeur d'Alene and Spokane, 33 miles, is making surveys for building an extension to Liberty Lake, on which work is to be commenced at once.

Consolidated Railway Company (Electric).—It is understood that this auxiliary company of the New York, New Haven & Hartford will build an electric road from Central Village, Conn., through the towns of Lisbon, Jewett City and Versailles, where it will connect with the Norwich Road, 15 miles, supplying the connecting link for a continuous electric road between Worcester, Mass., and New London, 60 miles.

Denver, Enid & Gulf.—Surveys through Oklahoma and Kansas for the northwest extension have been completed. Work will be commenced at Enid as soon as the plans are approved by the officials at St. Louis. The proposed route runs to Kiowa, Kan., 100 miles, where it connects with the Missouri Pacific.

Denver, Northwestern & Pacific.—This road, it is reported, has definitely located the route of its proposed road through Routt County, Colo.: from Hot Sulphur Springs in Grand County, the line will run west to Kremmling, then northwest to Steamboat Springs, following the Bear river westward, passing through Hayden and Craig, through Yampa canyon into Utah at the junction of the Yampa and Green rivers, 176 miles. Profiles have been made and bids for grading will soon be asked.

El Paso, Mountain Park & Oklahoma Central.—R. L. Kelly, chief promoter of this road, it is reported, has surveys and profiles completed for building a road from Mountain Park, Okla., to Oklahoma City, 95 miles, and later an extension to Wagoner, Ind. Ter.

Great Northern.—This company, which is building an extension from Bismark southwest towards Minot, of which 52 miles

has already been completed, will extend its road southeast from North Dakota to Sioux City, making a connection for the Great Northern, Northern Pacific and Burlington roads. It will give a direct route from the Northwest to the coal fields of Iowa and Missouri. The connecting line from this city to Omaha, when the northern line is finished, will shorten by several hundred miles the route from western bituminous fields into the Northwest.

GULF, HUTCHINSON & NORTHWESTERN.—Surveys have been completed by T. G. Elbury, Chief Engineer, for the line from Atwood, Rawlins County, Kan., to Stockton, Brooks County, about 100 miles. Contracts for grading and construction will probably be let next month. The road will later be extended from Stockton to Hutchinson. Eugene Tilleux, of Hutchinson, Kan., is President.

HAMPTON & YORKTOWN.—Incorporation has been granted this company in Virginia to build an electric road between Hampton and Yorktown, 20 miles. Frank W. Darling is President.

HILLSBORO & SOUTHWESTERN.—Incorporation has been granted this company in Illinois with a capital stock of $100,000 to build a steam road from Hillsboro, Ill., to Alton, 40 miles. The incorporators are: Frank P. Blair and F. A. Chapman, of St. Paul, Minn.; A. W. Crawford and others, of Hillsboro, Ill.

INDIAN TERRITORY TRACTION.—Press reports state that this company will at once begin an extension of its line from South McAlester, Ind. T., to Hartshorne, 15 miles east of that place.

INDUSTRIAL RAILROAD CO.—Application will be made to the Mexican government for a concession to build a system of railroads through rich agricultural districts in the State of Vera Cruz.

KANSAS CITY, BURLINGAME & WESTERN.—Preliminary surveys have been completed as far as Council Grove, Kan., which will be the present terminus of the road. Contracts will soon be given out for bridge work and grading. A. L. Hartbridge, of Olathe, Kan., is Chief Engineer. (May 6, p. 354.)

KETTLE VALLEY.—This company, which operates the Republic & Kettle River Valley and the Kettle River Valley lines, comprising 42 miles of road, is making surveys for an extension from Grand Forks, B. C., to Lynch creek, 18 miles, and this fall surveys will be continued to Franklin camp, 45 miles. Construction work will be started early next spring. H. W. Warrington, Grand Forks, is General Superintendent.

LA CROSSE & SOUTHEASTERN.—Work, it is reported, has been resumed on this road, and it is expected that trains will be running between Viroqua and La Crosse, Wis., by November 1.

LINCOLN & ONEIDA COUNTY.—Incorporation has been asked for this company in Wisconsin to build a road from Jeffris northeast into Oneida County, 12 miles. The incorporators are: J. H. Woerden, E. N. Morrill, Edward Faust and others.

MEXICAN INTERNATIONAL.—It is reported that this road, which has recently been taken over by the Mexican Government, has found a route for its proposed extension from Durango over the Sierra Madras to the port of Mazatlan, on the Pacific coast, 225 miles, and that building will be commenced as soon as surveys are finished and the work approved by the government.

MEXICAN ROADS.—A number of French and British capitalists are organizing a company in Mexico to build a road from Tepic, State of Jalisco, Mexico, to Santiago, 80 miles, with a branch to the port of San Blas, 30 miles, on the Pacific coast. The company will have a capital of $2,000,000 gold and has obtained a concession from the government through J. Rodger Wahl, of Mexico City, who represents the syndicate. The road will pass through a rich agricultural country as well as an extensive mining district.

MONTEREY COAL & COKE.—This company, which is an auxiliary of the Monterey Iron & Steel Co., is building a road from Menor, Mex., to the town of Sabinas, 20 miles, where connection will be made with the Mexican International. Vincente Ferrara is President.

MORGANTOWN & KINGWOOD.—This line will be extended from Masontown to Rowlesburg, W. Va., 15 miles. A. S. Brady is Chief Engineer.

NATIONAL OF MEXICO.—Surveys, it is reported, are now in progress for the proposed branch of this road from a point on the main line near Matamoras to Tampico, 275 miles.

OVERTON COUNTY.—This company, it is reported, has surveys completed for building from a point on the Tennessee Central to Livingston, Tenn., 18 miles, and contracts for the work will soon be let by the Southern Construction Co., of Philadelphia.

ROCKFOLD & FREEPORT.—This company has taken over the Rockford & Interurban Co., which operates all the traction lines in Rockford, Ill., with the exception of the Rockfold, Beloit & Jamesville Co. This gives the Rockfold & Freeport control of 40 miles of track outside and 25 miles inside of this city.

ST. LOUIS & SAN FRANCISCO.—This road, it is reported, has options on land at St. Bernard, La., which is to be used as a site for terminals. Plans, now ready, include a system of docks, to be one of the largest in the south, on which work is to be commenced in a short time.

SAN PEDRO, LOS ANGELES & SALT LAKE.—This company expects to have its line completed from Salt Lake to the Pacific coast by December next. There is a section of about 70 miles to be built before the road is completed. The Salt Lake division is already operating from Salt Lake to Calientes, 336 miles, and between Salt Lake and Silver City to the Ophir and Tintic districts, 85 miles, and the Fairfield district, 50 miles. On the Pacific slope the road has 105 miles in operation. The unfinished portion and that already completed between Calientes, Nev., and Daggett, Cal., will open up one of the largest mining districts in the west.

SIERRA GRANDE LUMBER COMPANY.—This company, which recently bought about 40,000 acres of land in the State of Colima, will build a railroad to connect the lumber mills to be built on this line with the railroad at a point near Colima, about 40 miles.

SUWANEE & SAN PEDRO.—An extension of this line is being built between Parry, Fla., and Hampton Springs, six miles. This extension will open up a fine timber belt and farming section.

SWAINSBORO & STATESBORO.—Incorporation has been asked by this company to build a road from Swainsboro, Ga., via Summit to Statesboro, 40 miles. A. A. Turner, J. D. Overstreet and others, of Summit, are interested.

WESTERN ROADS.—Application has been made to the Chamber of Commerce of Boise, Idaho, for a right of way for a distance of 10 miles east and 20 miles west from the city and for 40 acres for a site for machine shops for the proposed road to be built from Casper, Wyo., to run through the Jackson hole and Teton country, touching at Hailey, Idaho, west through the mountains to the South Boise valley, crossing the Snake river near Nyssa, through the Malheur valley to Vale, Ore., thence west to the coast at some point in West Oregon, 898 miles. F. L. Evans, of Boise, the Secretary of the Missouri Trust Co. and the First Vice-President of the American Central Insurance Co., St. Louis, are the principal promoters of the road.

RAILROAD CORPORATION NEWS.

ATLANTIC & DANVILLE.—Second mortgage 4 per cent. bonds of this company to the amount of $775,000 have been listed by the New York Stock Exchange.

BOYNE CITY & SOUTHEASTERN.—This company, which operates a road from Boyne City, Mich., about 20 miles long, has been offered a bonus of $5,000 by the town of Gaylord, when its extension reaches that point, which, it is expected, will be in the course of about 60 days. An additional $5,000 will be paid the road on its completion of 105 miles to the town of Alpena.

BROOKLYN RAPID TRANSIT.—The New York Stock Exchange has listed $5,000,000 refunding convertible 4 per cent. bonds of this company, recently sold, making a total of $10,000,000 to date.

BUFFALO & SOUTHERN.—A certificate of reorganization of the Buffalo, Hamburg & Aurora has been filed in New York, changing the name to the Buffalo & Southern, with a capital of $1,960,000. The directors are: P. C. Blasdell, of Bradford, Pa., and Theo. N. Barnesdall, of Pittsburg.

CHESAPEAKE & OHIO CANAL.—The State of Maryland will sell its interests in this company and is asking bids for December 1. An officer of the company is reported as saying that the State could sell its interest in the property, but would not guarantee those interests to the purchaser. The land for the route of the canal, was originally condemned for a waterway and if used for any other purpose than that of a water transportation route, it will probably revert to the original owners. The Baltimore & Ohio Railroad has control of this waterway, which it is now operating under the direction of Second Vice-President U. S. Bond, Jr.

CHICAGO & ALTON.—At the special meeting of the stockholders September 7, an issue of $5,350,000 of 3 per cent. bonds was authorized; $350,000 of the proceeds will be used to pay for the Quincy, Carrollton & St. Louis Railroad, and the remainder will be paid over to the Chicago & Alton Railway Co. for improvements on the property of the original Chicago & Alton Railroad, which is leased to the Harriman Co. Books have been closed for the annual meeting October 4.

CHICAGO, ROCK ISLAND & PACIFIC.—The directors have declared a quarterly dividend of 2¼ per cent. on the stock of this company. Preceding dividends recently declared on this stock have been 1¼ per cent. The rate paid on the original Rock Island stock is quite irregular, being governed largely by the income of the present holding company.

CHICO & NORTHERN.—This company has filed an application in California to increase its capital stock from $1,000,000 to $2,000,000. the additional stock to be divided into 20,000 shares of $100 each. The proceeds are to be used in extending and improving the road.

CINCINNATI, BLUFFTON & CHICAGO.—A meeting of the creditors of this road was held in Portland, Ind., August 30, to perfect a plan for taking the road which operates between Bluffton and Pennville, 19 miles, out of the receiver's hands and completing its construction. Senator Albert J. Hopkins, of Illinois, is said to represent a number of Chicago capitalists who have under consideration the purchase of the road.

ERIE.—This company has made application to the New York stock exchange to list $1,000,000 additional general mortgage bonds of 1996.

GRAND TRUNK PACIFIC.—This road has elected Charles M. Hays, President; Frank W. Morse, Vice-President; William Wain-

wright, Second Vice-President; Henry Phillips, Secretary; Frank Scott, Treasurer, and H. W. Walker, General Auditor.

HUDSON VALLEY.—Daniel J. Halpin, of Waterford, N. Y., has commenced suit against this company to foreclose the mortgage which secures $55,000 bonds held by him, on which the company failed to pay interest due January 1 and July 1, 1903. Application has also been made for the appointment of a receiver on the ground that the road is insolvent and unable to pay operating expenses on the street lines which it operates, about 100 miles long, in the neighborhood of Albany, Troy and Saratoga. The motion for the appointment of a receiver is to be heard September 17 before Judge Kellogg at Plattsburg, N. Y.

INDIANAPOLIS SOUTHERN.—Negotiations, which have been pending for several months for the sale of this road to the Illinois Central, have been closed. The $5,000,000 bonds of the road have been bought by the Illinois Central and will be held in that company's treasury. The road is now under construction from Indianapolis south to Sullivan, Ind., 110 miles, and will give the Illinois Central, in connection with its Effingham division, access to Indianapolis and an outlet for the coal and stone in that territory.

LAKE SHORE & MICHIGAN SOUTHERN.—The report of this company for the year ending June 30, 1904, shows an increase in operating expenses of $2,499,159, a decrease in net earnings of $953,645, and a decrease in surplus of $1,562,373. Heavy increases in fixed charges, dividends and operating expenses are responsible for the small surplus since the gross earnings also show an increase of $1,545,514.

MAINE CENTRAL.—The annual report of this company for the year ending June 30 shows gross earnings of $6,991,621, an increase of $257,137. Operating expenses increased $219,276, largely due to the higher cost of motive power and for new improvements. Net receipts increased $37,860; after deducting all fixed charges, the surplus for the year was $83,304, a decrease of $25,323 over 1903.

MISSOURI, KANSAS & TEXAS.—At a meeting in Parsons, Kan., August 31, the directors ratified the buying of Oklahoma roads and authorized the issuing of first and second refunding mortgage to secure an issue of $40,000,000 bonds to buy roads in Missouri, Kansas, Oklahoma, Indian Territory, Arkansas, Nebraska, Colorado and New Mexico, and to provide for terminals at Kansas City, St. Louis and other points on the road and for additional rolling stock.

MUSCATINE NORTH & SOUTH RAILROAD.—This road will be sold at public auction at Muscatine, Iowa, on Oct. 5, under an order from the United States Circuit Court to satisfy a judgment in foreclosure proceedings brought by the New York Security & Trust Company, which is trustee for the mortgage bonds of the railroad.

MUSKOGEE SOUTHERN.—A deed has been filed conveying the property of this road to the Midland Valley Co. The property consists of 38 miles of track from a connection at Muskogee, Ind. T., with the Ozark & Cherokee Central, to the west bank of the South Canadian river in the Cherokee nation. The purchase price was $20,000 per mile.

NEW YORK, ONTARIO & WESTERN.—A special committee of the Board of Directors has been appointed to investigate the application of the stockholders to abolish the voting trust. President Fowler is quoted as saying that the plan, when finally formulated by the board, will be submitted to the stockholders at a special meeting to be called as soon after the annual meeting as practicable. If the shareholders, at this meeting, approve the plans submitted to them, the company will be enabled to provide means for building the work now under way and for making improvements and additions to the property and extensions of existing lines in the future, as required, and to reimburse the net revenue account to an extent that will enable the payment of dividends from the common stock, thus terminating the right of the preferred stock to elect eight of the 13 directors. The report of this company for the year ending June 30 shows receipts of $6,652,438 as compared with $6,176,517 in 1903. Operating expenses were $5,072,937 as against $4,577,086 in 1903, and net earnings, $1,579,746 as compared with $1,619,431 in 1903, a decrease of $39,685. During the year, $1,031,931 has been spent for double track, and the management is carrying out a policy to use the surplus earnings for double tracking the road throughout. President Fowler says that $1,400,000 is needed for building the remaining 55 miles of second track.

PHILADELPHIA RAPID TRANSIT.—Executors of the estate of the late William L. Elkins have sold all of his holdings of this company's stock amounting to about 50,000 shares. Large holders of this stock expect that $15 per share will be called in instalments of $5 each to provide $9,000,000 to carry out the completion of plans for subway and elevated roads.

PITTSBURG, CINCINNATI, CHICAGO & ST. LOUIS.—An agreement has been reached between the city of Cincinnati and this company to carry out the ordinance to abolish grade crossings within the city limits at a cost of $1,500,000. This is to be equally shared by the city and the railroad company, except that where street surface railroads cross, one-half of the city's share will be borne by the street railway company.

READING COMPANY.—This company recently declared a semi-annual dividend of 2 per cent. on the first preferred stock. In 1896, when the voting trustees, J. P. Morgan and Frederick P. Alcott, of New York, and C. S. W. Packard were appointed guardians of the stock, it was stipulated that, until 4 per cent. per annum had been paid on the first preferred stock for two consecutive years, all the shares should be controlled by the voting trustees. With the payment of the last dividend, the voting trust of the corporation was dissolved and the affairs of the company will in future be in the hands of the shareholders.

SOUTHERN.—The issue of $2,955,000 4½ per cent. equipment notes has been sold. They are secured by locomotives and cars worth $3,478,245; $150,000 are redeemable semi-annually up to Dec. 1, 1907, and $147,000 each half year thereafter to December, 1914.

TEXAS & OKLAHOMA.—This company, which has recently been consolidated with the Missouri, Kansas & Texas, is offering through Clark, Dodge & Co. and Lee, Higginson & Co., $2,347,000 of first-mortgage 5 per cent. gold bonds due Sept. 1, 1943, at 99 and accrued interest.

WESTERN PACIFIC.—Announcement is made that Edward T. Jeffrey, President of the Denver & Rio Grande, has been appointed a director of the Western Pacific, which would seem to indicate that this road will form some alliance with the Gould system. The Western Pacific, which was organized to build a road from Salt Lake to San Francisco, 850 miles, with branches in California, making a total of 1,250 miles, it is said, has determined the route of its new line over the Sierras, and is in the market for material to be used in its construction. About $3,500,000 has already been spent on this road for construction and for extensive terminals in San Francisco.

WESTERN MARYLAND.—The New York Stock Exchange has been asked by this company to list $28,760,000 first-mortgage, 4 per cent. bonds of 1952.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY BY
THE RAILROAD GAZETTE
At 83 Fulton St., New York.

EDITORIAL ANNOUNCEMENTS:

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name, Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

FRIDAY, SEPTEMBER 16, 1904.

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